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NAVAL ADMINISTRATION AND ORGANIZATION.

Motto: The Country—The Service—The Individual.

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It is with considerable hesitation that the writer selects so broad and comprehensive a subject as Naval Administration and Organization for the theme of an essay; but existing conditions leave so much to be desired in both the administration and organization of the Navy that any honest effort for improvement, however imperfect, may do some good, and will at least do no harm.

The treatment of so extensive a subject in a limited space permits of only very general ideas being given, and very broad lines being drawn; and the remarks that follow are not offered as a structure complete in all its parts, but rather as a mere framework of suggestion to those who have the interests of the service at heart, in the hope that abler hands may take up the work and carry it to full completion.

As it stands to-day, the Navy could hardly be said to be more than an aggregation of individuals, without proper cohesion, or

unity of purpose. The individuals are excellent in themselves, whether they be men or ships; but something more than an aggregation of them is needed to make the service the complete, harmonious, homogeneous whole that it should be, working with one purpose for the advancement and glory of the country. That is the final end for the attainment of which all lovers of the service should strive, and the remarks and suggestions that follow are a feeble effort in that direction.

The subject-matter selected for discussion will be taken up in the order of the two great heads of the title, and we will discuss first—

ADMINISTRATION.

Naval administration, to the mind of the writer, includes all things pertaining to the direction of the naval policy of the country; the organization of the Navy Department or central office of naval administration, and its apportionment into the proper divisions and subdivisions; the direction and control of the naval personnel; and the formation, direction and control of fleets.

Up to the present time it would be more than bold to say there has been any naval administration at all in the true sense of the term. Certainly there has been no fixed naval policy, nor any logical, consecutive system of development. As new needs have arisen from time to time, a new bureau or a new office has been created here and there, and grafted on the old system without any proper co-ordination, or logical plan for future development. The result has been a heterogeneous mass of old and new, without cohesion of parts or unity of design, and with frequent rivalries between parts where there should have been nothing but co-operation. The law of its growth has been the expediency of the moment, and reason, logic and foresight have had little or no part in its development. It may be said to exist only by the force of custom, and to attain any degree of efficiency only by the strength and character of many eminent bureau chiefs.

This spirit of following the law of expediency, rather than logical plan and system, permeates the entire naval establishment, but more especially its administration, and has done more to delay true naval growth than any other cause. It is founded on the moral weaknesses of some, the personal ambitions and jealousies of others, and the want of foresight and ideas of false

economy of all; and the sooner it is swept aside, and reason and logic substituted therefor, the better it will be for both the country and the service.

It may be accepted as an axiom that all creations—whether of the intellect or the hands—that are destined to live and bear good fruit are founded on reason and the natural order of things; and since we wish our naval administration to be a living force in itself, and not dependent entirely on the force and character of passing individuals, let us see if it is not possible to organize it on a natural and logical basis, to the end that naval development may be continuous and progressive, despite the short-comings and failures of any individual heads or chiefs.

It is a necessary consequence of our form of government that the official head of the Navy shall be a civilian who usually goes into office nonconversant with naval duties, customs and traditions. While this has its disadvantages, in that it frequently exposes questions of a purely technical nature to the decision of one necessarily ignorant of their bearings, it has the undoubtedly great advantage of supplying the Navy with a head free from the contamination of service cliques and corps, and of giving it an impartial arbitrator in service disagreements. In many ways it would tend much more to thorough efficiency if the head of the service knew and *felt* all its aims and needs, and were in full personal sympathy with it; but this same result can be attained, to a great extent, by the proper selection of his subordinates; and our system of placing a non-naval and military man at the head of the navy is, perhaps, the wisest that could be designed. However, whether it be wise or unwise, the system will always be followed as long as our government lasts, and further discussion of it is useless; and we will proceed to the consideration of what improvement may be accomplished under him.

As at present constituted, the affairs of the Navy Department are administered by a number of independent, or semi-independent, bureaus and offices, sometimes working together—though more through accident than design—but more frequently at odds, and with little or no military subordination and sequence or natural and logical groupings. If the matter be looked at broadly, from either a statesmanlike or a military point of view, the whole comprehensive subject of naval administration naturally and logically divides itself into two, and *only* two, great divi-

sions—1st, that of the personnel, and 2d, that of materiel. Therefore, logically and naturally, the affairs of the Navy should be administered under these two heads, and under these two only. For all division of responsibility beyond that required by reason and logic tends to weaken the responsibility and promote carelessness, diffusion and general inefficiency.

The Division of the Personnel should comprise all that relates to the naval personnel, its training, discipline and detail; all that relates to preparation and plans for war and action; all that relates to the direction and control of commissioned ships and fleets; or, generally, all that pertains to the Navy as a *military* and *fighting* organization.

The Division of Materiel should comprise all that relates to the design, construction, equipment and maintenance of ships, ordnance, machinery, yards, docks, etc.; or, generally, everything that pertains to the creation and maintenance "in being" of the most efficient and largest fleet allowed by the laws.

Just as naturally as the whole administrative system divides itself into these two great heads, these divide themselves into certain subdivisions, that will be discussed under their appropriate heads.

Personnel.

Taking the divisions in the order of their importance, we will consider first the personnel. This division should have for its chief an officer who would be the true *military* head of the Navy. He should be carefully selected from the highest grade of the line, and, as Chief of Personnel, should be the ranking officer of the Navy. He should be the chief adviser of the Secretary in all matters of naval policy, and should direct and be responsible for all the matters above enumerated as comprising the Division of Personnel.

No one thing has done more to foster laxity of discipline, develop insubordination, and check the growth of a proper military spirit and "esprit de corps" than the want of this military head; and until such is established all hope of thorough reform and of moulding the Navy into as perfect a fighting machine as human nature permits is vain.

Heretofore the duties of a semi-military head have been performed by the Chief of Bureau of Navigation; but his scope has

been far too limited, and his position too anomalous to accomplish much good—in a military sense. What is needed is a genuine military head, recognized by the law and by the service as such; and such a head should be the Chief of Personnel.

For the administration of naval affairs relating to personnel, the Division of Personnel should be composed of the following branches or subdivisions:

(1) *The General Staff.*—This most important of the subdivisions of personnel is yet all to be formed, except such small parts of its duties and functions as have heretofore been performed by the War College and Office of Naval Intelligence. From the nature of the requirements of a general staff, its formation in completed perfection can only be an accomplishment of time. Hence its development should be begun at once.

The official and legal recognition of a general staff and the selection of a proper chief, with a limited corps of assistants, and with the Office of Naval Intelligence and the War College placed under him, would be a long step in the right direction.

The Chief of the General Staff should be next in rank in the personnel branch of the service to the Chief of Personnel, and should occupy towards that chief the same position that the latter does to the Secretary. He should be the chief adviser of, and replace the Chief of Personnel in case of absence, sickness or temporary disability.

(2) *Bureau of Naval Organization and of Detail.*—This bureau should have charge of the organization of ships' complements, of squadrons and fleets, of all drills and systems of military instruction, of keeping the records of all officers and men in the naval service, and of the detail of all officers and men to ships and stations for the utilization of the varying talents of all to the best interests of the service.

Perhaps there is no subject connected with naval administration that requires more tact and fine judgment than the detailing of officers and men to fill the positions for which they are best fitted, and for the best interests of the government; and there is none that has usually received less attention, especially in the lower grades. Our present system requires all men to be all things, and attempts to eliminate human nature from the most human of all problems—the control and handling of men. It would be difficult to find an officer of 20 years' experience who

has not at some time in his career sailed with an executive officer who could not execute, a navigator who could not navigate, and a watch officer who could neither control the crew nor handle the ship. Each of these officers may have been excellent on some other line of duty; but the system required that he should fill a position for which he was unfitted, to the loss of discipline and efficiency, or the hazarding of the lives of a ship's company and the safety of the ship. The duties of the Navy are so varied that there is room for talent of all kinds, and the "detail" duty of this bureau should be one that receives the most careful consideration, and the personal supervision of its chief.

(3) *The Office of Naval and Military Law and Discipline.*—This office should have cognizance of all matters pertaining to the administration of law and justice in the Navy, and the enforcement of discipline under the laws. It is essentially a branch of the personnel, and should therefore be placed under the direction of its chief. The head of the office should be known as the Judge Advocate General, and should be chosen from the active officers of the Navy well versed in military law, and in close touch with naval customs and the needs of naval discipline. This close touch with naval customs and needs being as essential to the efficient administration of naval justice and discipline as a knowledge of the law; the term of office of the Judge Advocate General should never exceed eight years, and would be better limited to four.

One of the first duties of this office should be the preparation, for submission to Congress, of a new code of laws for the administration of justice in minor offences, the clearer separation of minor and grave offenses, and the general simplification of the administration of law as conducted in the Navy to-day. The necessity for this simplification, and of the proper classification of offenses and punishments by law is at the present time one of the most urgent needs of the Navy for the maintenance of discipline.

(4) *The Hydrographic Office.*—This office, as now, should have charge of the collection and dissemination of nautical information of all kinds; and the preparation of the charts, books, etc., needed for the proper navigation of the active fleet in all parts of the world. The work of this office is purely professional, and has no connection whatever with the materiel of ships. Therefore

it is difficult to see why it should be placed under an essentially materiel branch of the service, as at present, when logically it should come under the control of the division that would naturally apportion and direct its work.

MATÉRIEL.

Before taking up the detail discussion of this great division of the Navy, it might be well to preface it with some general remarks on the advisability of its consolidation.

As the department is at present organized, the affairs of the materiel of the Navy are administered, under the Secretary, by a number of equal, co-ordinate, independent heads, frequently disagreeing among themselves from that ineradicable trait in human nature that causes almost every individual to magnify the importance of the part of any joint work designed by himself. These disagreements—most usually on technical questions, and arising from honest differences of opinion—must be referred for decision to the Secretary, who, however great his ability, has rarely the technical education and training that would fit him to decide them to the best advantage.

The parts of a modern ship are so various, and involve so many distinct professions, that many minds are necessarily engaged in evolving the finished vessel. The constructor, the engineer, the ordnance officer, have each and all been necessary to form the completed whole, and many compromises have been made between them from the inception of the plan to the time the finished ship is ready for service. That in the adjustment of these compromises many disagreements should arise is only human; and, in the opinion of the writer, their settlement, and the general building of the Navy, would be much facilitated if there were a common head to all the branches engaged in work on materiel with sufficient technical knowledge and experience of ships to decide the question intelligently, and with sufficient authority to settle them. Not only would the work be much facilitated, but the Secretary would be relieved from a most onerous duty, and one that he must have frequently felt himself unqualified to fill.

Although men of the high attainments, broad technical knowledge and administrative ability necessary to fill successfully the responsible position this head must occupy are not common in any profession, there are, and always will be, a rare few in the

Navy, as there are in all other great professions; and from these few the head or chief of materiel should be chosen. It is the same type of men that are found filling the positions of general managers and superintendents of all the great industrial enterprises of civil life.

Though a chief of specialists, he need not be a specialist himself; but must be, however, a man of extensive mechanical ability, and of broad experience of ships *at sea* under all conditions of service; and, above all, of great executive ability.

He should by law be the officer next in rank in the Navy to the Chief of Personnel, and should be the chief adviser of the Secretary in all matters relating to the creation and maintenance of fleets, and should have control and direction of all navy yards and repair stations.

Consolidated under his authority, instead of being the independent co-ordinate powers they are to-day, should be the following subdivisions:

(1) *The Bureau of Construction.*—This bureau should have cognizance of all the affairs of materiel relating to the design, construction and repair of ships, docks and stations, and should have the care of all navy yards and repair stations. Its chief and assistants should be constructors and constructing engineers of the highest type obtainable; and the chief should bear the same relation to the chief of matériel that that chief bears to the Secretary.

The present bureau of yards and docks, and the system that has heretofore prevailed of laying out and designing our navy yards and stations under many heads would seem to be illogical, and has certainly led to much unnecessary expense and confusion. The placing of the whole navy-yard system under the one head that controls the great bulk of the work done in them, would seem to be reasonable, and would undoubtedly lead to economy, efficiency, and to the adoption of a systematic plan in the arrangement of shops and buildings.

(2) *The Bureau of Engineering.*—This bureau should comprise everything relating to the design, construction and management of all machinery in the Navy, both ashore and afloat, except that relating to ordnance. Its chief and assistants should be mechanical engineers of the highest order; and, to be such, can be nothing else.

(3) *The Bureau of Ordnance.*—This bureau should have cognizance of the design, building and care of all ordnance, ordnance material and appliances, and of all armor used in the Navy; and have control of all naval gun foundries and proving grounds.

The handling and management of naval guns and all their appurtenances being distinctly among the primary duties of the line, the chief and assistants of this bureau should be chosen from that branch of the service from among those who have made a specialty of ordnance matters by natural predilection.

Moreover, excellence in design and construction can only be attained by the application of the intimate knowledge and experience gained in the actual use of the guns and their appliances in all the varying conditions of active service. This knowledge and experience can only be obtained at sea; and, therefore, the ordnance expert must be also a sea-going officer, and should never be segregated from the sea-going line into a distinct and individual corps.

(4) *The Bureau of Equipment.*—This bureau should control the fitting and arrangement of the entire equipment of vessels, except that of ordnance and machinery.

The chief and assistants of this bureau should be taken from the line of the Navy, as full knowledge of the necessities of ship equipment can only be acquired by those who actually go to sea in ships, and learn from daily experience, in the varying conditions of sea life, what is actually needed for thorough efficiency.

In addition to the subdivisions enumerated above, the administration of the Navy requires two other important branches which are not so logically classible as being wholly of either the personnel or materiel as those already mentioned; and are yet not of the primary importance that requires the establishment of separate and independent divisions in the administration for the proper conduct of their administrative duties. These two branches comprise the duties now administered by the bureaus of medicine and surgery, and of supplies and accounts.

While the peculiar duties of these two branches render them both more or less independent of the natural classification of all the other branches, they are both of a subordinate character, and are adjuncts rather than primary powers in the administration. Therefore, it would seem more logical and in the right order of things to class them under the one or the other of the

two great divisions with which they are the more nearly assimilated than to form two more divisions of the first order in the administration for two essentially subordinate branches.

The duties of the surgical branch of the Navy bring it in close alliance with the personnel; and, therefore, it would seem logical to class that branch with the personnel, and the bureau of medicine and surgery as the 5th subdivision of personnel. It should be organized, as at the present time, except that it should act through the military head of the Navy instead of as an independent power.

On the other hand, the pay branch of the Navy in the purchase, transportation, and care of all the material of the Navy is, in its administrative duties, far more closely allied with the materiel; and hence the bureau of supplies and accounts should be classed as the 5th subdivision of that great division in the organization of the administration.

No other branches of the naval administration than those indicated above are either necessary or logical; and the division into the two—and only two—great divisions of the personnel and materiel would seem to be so natural and conducive to efficiency and unity of action, that the administration must have long since been formed on these lines but for the continued reign of the law of expediency, and the influences of personal ambitions and of politics.

The suggested organization of the naval administration then is:

1st. The head, the Secretary of the Navy.

2d. The Division of Personnel, whose chief would be the *military* head of the naval service, and who would be the chief adviser of the Secretary in matters of naval policy, and in all matters affecting the Navy as a military entity.

3d. The Division of Materiel, whose chief would be the chief adviser of the Secretary in all matters relating to the construction and maintenance of fleets, yards, docks and stations.

For the consideration of questions of naval policy of a wider and more deliberate nature, the chief of personnel, the chief of the general staff, the chief of the bureau of detail and organization, and their principal assistants, should form a permanent board on policy and naval strategy, under the presidency of the chief of personnel, for the assistance of the Secretary in creating and formulating the naval plans of the nation.

For the assistance of the Secretary in formulating plans for the creation and maintenance of the fleet, for deciding the types and sizes of ships, their armaments, speed, etc.; or, generally, everything connected with putting " in being " the most efficient fleet possible, the chief of materiel, chief constructor, chief of engineering, chief of ordnance, and chief of equipment should form a permanent board on construction, under the presidency of the chief of materiel, who should have the deciding voice.

The Secretary would thus, at all times, have at his disposal the experience and advice of the chiefs of the two great divisions of the naval administration; and in matters of graver import requiring further deliberation and discussion, could convene either the board of policy and strategy, or the board of construction—or both—according to the nature of the question.

In general, the Secretary should hold the chiefs of the two great divisions responsible for the proper performance of all matters relating to their respective divisions; and leave them to hold their subordinates to a like responsibility; for responsibility, properly carried, is the sure test of efficiency. It can be properly carried only when it proceeds from the head down, for in any efficient organization the head is *always* responsible.

It would be impossible to develop a complete scheme of naval administration in the narrow limits of an essay, and this branch of the subject matter of the title will be closed with the few broad suggestions offered above, for the majority of which no claim to originality is made. But it would seem that an administration organized and developed on the lines suggested would be following the laws of logic and reason, would prove efficient, lead to unity of purpose, develop the best in all branches, and promote a spirit of emulation and military " esprit de corps."

Organization.

Naval organization, like administration, naturally and logically divides itself into the same two great divisions—1st, that of the personnel, and 2d, that of the materiel.

Of these two, the first only will be treated at any length here. Given the ships—and Congress is giving them with a liberal hand—their proper organization into fleets and squadrons to meet any emergency is a simple matter. Plans will have already been prepared to meet any foreseen emergency by the proposed

general staff and board of naval policy and strategy. Any changes required by unforeseen variations in the emergencies can be easily and quickly accomplished by any master mind. But the proper organization of the personnel is a matter of slow development and education; and while a genius may perform prodigies with the faultiest of organizations, geniuses are rare, and the organization should be such that a leader of even ordinary ability can at least commit no grave faults.

The right and proper organization of the personnel is the vital and living question of the Navy to-day, and will be for all time. The tendency of our law-makers, as also of many of the more technically minded of our own body, is to forget the supreme importance of the *personal* side of all questions of naval efficiency, and to either ignore it, or, when forced to take note of it, make the vain attempt to eliminate human nature and capabilities from the problem. A ship, as a fighting machine, is always just as efficient as its officers and crew, and not one jot more, however perfect it may be in structure and design; and the finest battleship ever built, without a complement, is as worthless for fighting purposes as the veriest hulk in rotten row.

It would be well if these simple truths were borne in mind in the framing of laws, as well as in the making of details and complements in the Navy itself. For in all cases of action of any kind—and the Navy is solely and only designed for action—the *human* element is the far most important of all that enter, and should receive the consideration its importance demands.

The recent attempt to reorganize the personnel of the Navy by the passage of the law commonly known as the " Personnel Act " was, to the mind of the writer, a distinct step backwards, and against both logic and the spirit of the age. At a time when science in all its branches is advancing with such rapid strides, and when perfection and thoroughness in any profession requires the full and entire effort of even a superior mind, and when specialism is the watchword to eminence and success in all professions, to practically abolish one of the most absolutely necessary and most highly specialistic branches of a modern naval service would seem to be contrary to all reason and the teachings of experience. The composite substitute offered of a class of officers alternating from line to engineer may work efficiently in some future development of the human mind, but in

its present state will surely lead to disaster sooner or later. Taking the Navy as a whole, it would be difficult to select a more excellent class of material than that of which its officers are composed; but each individual, be he by nature a line officer or an engineer, requires all the powers of his intellect to be proficient in his own branch; and it is a rare genius who can be thoroughly efficient in the many requirements of both.

Neither the passage of a law nor the giving of a title makes the line officer, the engineer or the constructor. It is only years of hard work, study and training that make any of them; and while the rare genius mentioned above who can combine them all in his capacious brain may occasionally appear, a service like ours is not composed of such, and it would be the part of wisdom to accept human nature as it is and frame laws for men as we find them, and not for exceptions that may appear at long intervals.

Therefore, it would appear to be the plainest and simplest conclusion of logic that the practical abolition of the engineer corps of the Navy was a mistake, and cannot be rectified too soon for the good of the service. The present system will run for a time, for we have still in the service a number of trained engineers of the old system under another title. But in a few years these will be laid aside, and there will be none to take their places; for it is only too evident, even now, that the younger officers of the line, designed by the law to supply the need, do not as a class wish to, nor could many of them do it efficiently if they did, and still maintain proficiency in their own legitimate profession. The final result of the system continued is plainly apparent; inefficiently designed and cared for machinery, break-downs, delays and general inefficiency of the service as a fighting machine.

It is the firm conviction of the writer, founded on much thought and some study and experience, that the efficiency of the Navy absolutely requires the establishment of a corps of naval engineers who shall be engineers of the highest order obtainable, and nothing else, if we wish not only to keep our place with the advancing navies of the world, but if we wish to prevent ourselves from falling hopelessly behind, and meeting with disaster in the first great trial. If the present system be continued, sad experience and the logic of events will themselves re-establish this corps sooner or later; and that such experience

may be avoided and time not wasted, it would be wise to start the re-establishment as soon as possible.

On the other hand, this corps when re-established should be almost as far removed from the corps as advocated by many of the supporters of the old system as from the present system of nondescripts. Engineers of the highest order of training and education are needed on board ship; but large numbers of them are as little needed as would be a dozen Edisons to put up an electric bell wire. Any one would laugh at another for using a hundred ton derrick to hoist a hundred weight, when small cranes were plentiful and convenient; yet the system advocated by the enthusiasts of the old engineer corps is practically the same thing. There is room in the very limited space on ship-board for only what is necessary, and this room is too valuable and too much needed for other purposes to be wasted in quarters for unneeded officers.

But the need of the very highest class of engineers on board ship, in the numbers corresponding to the duties to be performed, is more crying now than at any time in the previous history of the Navy; and that need will become more and more urgent as the Navy expands, and machinery and mechanical devices increase and multiply. And while it will be absurd to use highly trained and educated designing and constructing engineers for engine drivers, one or more—according to the size of the ship and intricacy of the machinery—should be on all ships of the Navy as directors and superintendents of machinery, and should be held responsible for the proper working and efficiency of all machinery and mechanical devices in the vessel.

For this purpose, one is sufficient for gunboats and smaller cruisers, two for cruisers of the second class, and three for cruisers of the first class and battleships. Any greater number of engineers of the highest class on board ship is superfluous, and therefore useless. For the engineering work under them, the present system of warrant machinists, and machinists of the various classes, supplies just the order of material needed for the work to be performed.

This subject of the necessity for engineers on board ship and of the kind required has been entered into somewhat more fully than the length of this paper warrants; but the writer believes so firmly that in this lies the weakest point of our present naval

system, and that it will sooner or later lead to disaster if not corrected, that space has been sacrificed in the endeavor to bring out what he believes to be right views in as strong and convincing a light as possible.

Returning now to naval organization in general, the chief requirements for a proper and efficient organization are:

1. The organization should be such as to promote and encourage a true military spirit and emulation, maintain the "esprit de corps" of all branches of the service, and enforce discipline.

2. It should consist of all the branches necessary to the command, creation and maintenance of modern fleets, and no others; and should define the co-relation of these branches clearly.

3. It should be homogeneous, and, as far as possible, all branches should be drawn from the same source, to the end that there may be a feeling of kinship between all branches, and that all may start with a military training, and with some unity of feeling and mutual sympathy.

4. There should be a proper co-relation of numbers in the various grades of all corps, and provision made for a flow of promotion, that the age and rank of each grade may correspond with the duties of the grade. And there should also be provision made for expansion to meet the requirements of an increasing Navy.

In the first of the great requisites enumerated, the Navy has been much lacking, as far back as the knowledge of the writer extends. This is due to the lack of a proper military head to the Navy more than to any other cause; and the establishment of one in the person of the chief of personnel—as suggested in the discussion on administration—will do much to correct the evil. It has also been much fostered by the want of a true military system in the issuance of orders and filling of details, availability having generally been the guide rather than "good of the service."

The establishment of such a military head, and the following of a system founded on military efficiency by the suggested Bureau of Detail and Organization, would go far towards correcting all the defects of the present organization, and would tend much to promote a spirit of emulation and pride of service necessary to true naval efficiency and proper subordination.

The creation of this spirit would not be accomplished all at

once. The spirit of independence, bordering on insubordination, is too deeply rooted in the service, and is too much a part of the original birthright and nature of our people to be eradicated at a word of command. But the training should be begun immediately, and the reform should start at the top, as should all reforms.

In regard to the second requisite laid down, it will have been already observed that the writer is no great believer in the universal genius of man, and is firmly convinced that the best work is generally accomplished by men who devote their whole time and intellect to one profession.

Therefore he believes that the good of the service requires a separate corps for each great profession included in it and necessary to it.

These corps are:

1. The Line.
2. The Corps of Surgeons.
3. The Corps of Constructors.
4. The Corps of Engineers.
5. The Corps of Paymasters and Commissaries.
6. The Corps of Chaplains.

These corps, and no others, are necessary to a complete, logical naval organization.

The present corps of professors of mathematics is a relic of a dead system, and is an unnecessary adjunct to the Navy, and should be allowed to die out by no more appointments being made to it.

The present corps of civil engineers is an anomaly in a naval establishment filled with engineering skill, and its members should be joined as an adjunct to construction,—which latter branch should have charge of the maintenance of yards, docks and stations,—and no further appointments to the corps made. In the future the construction corps should contain its engineering experts to do the duties now performed by civil engineers, just as the line contains to-day its ordnance experts, and for very much the same reasons.

The co-relations of the various corps have already been indicated in the discussion on administration, except those touching the corps of chaplains, and these need no explanation.

In discussing the third of the requisites laid down above, it

may be well to recall to mind a few of the commonest and most every-day traits of human nature. The impressions, feelings and sympathies of youth are the most vivid and lasting of life. The bonds of sympathy and fellow-feeling that last throughout life between men of a common Alma Mater are well known. It is equally well known that, with few exceptions, the true military feeling and instinct is never imbibed in mature life; and that the average man who has failed to have military training in his youth may wear epaulettes for half a lifetime with little more of genuine military spirit at the end than when he began, and chafes at the necessary restraints of military life, to the detriment of discipline always. These traits and feelings come out even more strongly in a naval service, where men are thrown so closely together as on shipboard, than in a military service on shore.

Since human nature is thus, and since unity of purpose combined with love and comprehension of the whole service, and a true military spirit, are so necessary in adjusting the many conflicting interests that arise in the building and fitting of ships, and the conduct of naval affairs, it would be well to take advantage of these traits, and to organize the Navy in the manner most calculated to make the best use of them. Such unity of feeling, comprehension of military necessities, and sympathy and understanding between branches can only obtain when all have received the same military training, and have imbibed their impressions and knowledge at the same source.

For these reasons, all branches of the naval service, with the exception of the surgeons and chaplains—who form distinct non-combatant classes—should be drawn from the Naval Academy; and Congress should make provision for a sufficient number of cadets to supply all needs.

In the apportionment of the cadets into corps, after two years training in common, the individual cadet should be allowed a certain latitude in selection, though the final decision should rest with the Academic Board. Then each branch should be trained and educated in its own profession. The candidates for the pay corps, whose profession requires little technical training beyond the development of natural business aptitudes, should take the line course, and be trained to be capable of commanding men on board ship in case of need. The course of the candidates for the construction corps should be considerably extended in

the mathematical and engineering branches, and a school of construction founded as a component part of the Academy.

In this way, and in this way only, can a homogeneous naval personnel be established; and though each branch follows its own profession, all have a military training, and all have a common feeling of sympathy and fellowship, that brings with it a comprehension of the needs, aims and ambitions of the others.

The selection of a standard as a basis for discussion is necessary for consideration of the fourth and most comprehensive of the requisites laid down. We have now completed 7 first-class battleships, 2 armored cruisers, and a number of vessels of lesser importance. We have under construction—or authorized—10 more first-class battleships, 6 armored cruisers and a number of lesser cruisers, monitors, gunboats, destroyers, and torpedo-boats. The completion of the ships under construction, and already authorized, will considerably more than double the fighting efficiency of the Navy as it exists to-day, as regards materiel, and will give us a fleet of 17 first-class battleships, 8 armored cruisers, 1 second-class battleship, and a large number of lesser cruisers, large and small, with monitors, gunboats, destroyers, torpedo-boats and auxiliaries numbering 214 in all, not counting obsolete monitors, receiving ships and state school ships. This expansion of the materiel bids fair to continue as the country itself grows and expands, and each succeeding Congress adds to the splendid roll already borne on the list of ships.

While this vast expansion of the fleet has been, and continues to be, so liberally provided for by our lawmakers, *nothing* has been done to meet the corresponding increase demanded in personnel. If this blind policy is to be pursued, it would be much better to save the money of the people, cease building and trust to Providence for our defense. It takes years to make a battleship, but it takes more years still to make a naval officer; and the former is worse than useless without the latter, in that its being gives a false hope of protection and security that will lead to worse disaster than an acknowledged lack of all protection. Therefore, it would be wise, if we are to continue the increase of the fleet, to at least start the increase of personnel with it.

But this is a matter that rests with Congress, and so a useless discussion for the purposes of this paper; and we will return to the point in question, of the selection of a standard, and the organization of the grades of the Navy to fit the standard.

As the fleet already provided for enumerated above will be exceeded in a very few years, let us take for our standard fleet in commission, for the purposes of our argument, a fleet of:

20 battleships.
10 cruisers of the 1st class.
20 cruisers of the 2d class.
20 small cruisers.
40 gunboats.
20 destroyers.
20 torpedo-boats.

It will be observed that the list includes only sea-going and fighting ships proper, and does not include auxiliaries of any kind; for the handling of colliers, supply-ships, etc., has never appeared to the writer to be the legitimate duties of a naval officer, and would seem to be a reversal of the old adage of the silk purse and the sow's ear. The whole transport system, however, should be under the control of the Navy Department, and should so sensible and logical a change ever be made the lists given below should be increased by the number of officers required for that service.

In the following enumeration of officers required for the ships of the various classes, only the *least* number possible for anything approaching battle efficiency will be given, and many of them, especially the battleships and large cruisers, should have more to contend on equal terms with the ships of their classes in other navies.

A battleship or cruiser of the 1st class should carry 1 captain, 2 lieut.-commanders, 5 lieutenants and 8 lieutenants (junior grade) and ensigns, or 16 commissioned officers of the line. 1 chief engineer, 2 assistants, 2 surgeons, and 1 paymaster, or 6 commissioned officers of the staff. In addition to these, they should carry 2 gunners, 1 boatswain, 1 carpenter, and at least 5 warrant machinists, or 9 warrant officers. This makes a total of 22 commissioned officers and 9 warrant officers, or 31 officers of all kinds.

A cruiser of the second class should carry 1 captain, 2 lieut.-commanders, 3 lieutenants, 2 lieutenants (junior grade) and 5 ensigns, or 13 commissioned officers of the line. 1 chief engineer, 1 assistant, 2 surgeons, and 1 paymaster, or 5 commissioned officers of the staff. In addition they should have 1 gun-

ner, 1 boatswain, 1 carpenter and 4 warrant machinists, or 7 warrant officers, making a total of 18 commissioned officers and 7 warrant officers, or 25 officers of all kinds.

A small cruiser should carry 1 commander, 1 lieut.-commander, 3 lieutenants, 2 lieutenants (junior grade) and 3 ensigns, or 10 commissioned officers of the line. 1 engineer, 1 surgeon, and 1 paymaster, or 3 commissioned officers of the staff. In addition they should have 1 gunner, 1 boatswain and 4 warrant machinists, or 6 warrant officers, making a total of 13 commissioned officers and 6 warrant officers, or 19 officers of all kinds.

A gunboat of the 1st class should carry 1 commander, 1 lieutenant, and 3 lieutenants (junior grade) or ensigns, or 5 commissioned officers of the line. 1 engineer, 1 surgeon, and 1 paymaster, or 3 commissioned officers of the staff. In addition it should have 3 warrant machinists, making a total of 8 commissioned officers, and 3 warrant officers, or 11 officers of all kinds.

A small gunboat or a destroyer should carry 1 lieutenant, 1 lieutenant (junior grade) and 2 ensigns, or 4 commissioned officers of the line.

A torpedo-boat should carry 1 lieutenant and 1 ensign, or 2 commissioned officers of the line.

Therefore, to maintain a fleet of the size selected as the standard in commission, in anything approaching battle efficiency, would require for actual sea service:

	Capts.	Comdrs.	Lt. Comdrs.	Lieuts.	Lt. (J. G.)	Ensigns.	Totals.
Line	50	60	120	350	270	410	1260
Engineers ..			30	50	70	40	190
Surgeons ..			50	50	60		160
Paymrs. ...			30	40	20	20	110

These numbers do not include the necessary flag officers, or their fleet or personal staffs, but simply include the officers necessary to man the individual ships.

It will be noticed that in the above table no staff officers above the grade of lieut.-commander are included in the officers pertaining to sea-going ships. And with the exception of the fleet staffs of flag officers, this is as it should be; for there is no place in either the quarters or complement of a single ship for a staff officer of higher rank.

Besides the officers actually at sea, a number will always be

required on shore in the naval administration, and at the various yards and stations, if we wish our ships armed, equipped and fitted to the best perfection. For it may be taken for granted that men with years of daily experience in the use and handling of all things pertaining to ships in actual service, are far more competent to superintend their armaments and fittings than any other class could be. Moreover, since they are destined to use and command the ships themselves, and their very lives and honor depend on the perfection of the preparation, they have a personal interest in this preparation being thorough that no one else can feel. Therefore, to determine the total number of officers required to maintain our standard fleet in commission, those who perform this class of duty must be considered, as well as those actually at sea; for preparation is little less important than action.

In establishing the ratio of the number of officers required on shore to those at sea, it is well to divide the Navy list into two classes: the "command" and advisory class, and the "working" class. The first would include all on the active list of and above the rank of commander; the second all of and below the rank of lieut.-commander. From the nature of the administrative and directory duties pertaining to the functions of the Navy on shore, the proportion of the "command" class required for these duties would be much greater than of the "working" class; and in the "working" class itself, the proportion should diminish as we go down the list, and the last grade of ensign should be a sea-going grade pure and simple.

As previously indicated, in the staff corps, except the number required for fleet staffs, *all* the "command" class should be on shore, where their duties naturally lie.

On July 1st, 1900—as shown by the official Navy Register—of the entire sea-going force of the line of the Navy, from the admiral to the lowest ensign inclusive, 67⅛ per cent were actually on ships. Dividing the same list into the "command" and "working" classes, there were 40⅓ per cent of the "command" class on ships, and a small fraction under 74 per cent of the "working" class. The remaining 26 per cent of the "working" class included not only those on shore duty proper, but those on shore duty on foreign stations, and all on sick leave and in hospitals.

With the present number on the Navy list, the percentage of the "command" class on shore is not unduly large; but as the Navy increases there will be but few more officers of those grades required for the shore duties than at present, and the *percentage* at sea with a larger list should be greater. The number of important posts on shore requiring flag officers, however, will always be considerably greater than the fleets in commission, and the present proportion of admirals afloat and ashore will not vary materially. There should be at the least 5 afloat, 6 in the administration, 6 in command of the six important stations, 2 for heads of boards, and at least one more for contingencies, or 20 in all.

For captains and commanders, the percentage at sea, with an increased list, should never be less than 50 per cent. This would require for the complete maintenance of the standard fleet under consideration a total of 100 captains and 120 commanders afloat and ashore.

Coming now to the "working" class, it is difficult to see how less than the present percentage of about 25 per cent for the numerous and multifarious duties on shore can be spared without grave detriment to the service. For it must always be borne in mind that the preparation of the tool is only less important than the skill in handling it, and only those who know and understand all its uses can prepare it properly and successfully.

But, naturally, the 25 per cent of the "working" class required for shore duty would be taken more from its higher and more experienced grades, while the lowest grade need have only surplus enough to allow for rest, sickness and waste. This could hardly be put at less than 10 per cent; and a good distribution for the other grades would be about 15 per cent for lieutenants (junior grade), 25 per cent for lieutenants, and 35 per cent for lieut.-commanders.

Therefore, to equip, fit, arm and keep in commission the standard fleet under discussion, requiring actually at sea—exclusive of flag officers and staffs—50 captains, 60 commanders, 120 lieut.-commanders, 350 lieutenants, 270 lieutenants (junior grade) and 410 ensigns, would require a total line force of 20 admirals, 100 captains, 120 commanders, 184 lieut.-commanders, 467 lieutenants, 318 lieutenants (junior grade) and 456 ensigns.

The duties of the engineer and medical corps being propor-

tionally more of a shore nature than those of the line (especially in the "command" class, which should be practically all on shore), a larger percentage of their sea-going classes are required on shore. There should be in both corps, above actual sea requirements, at least 40 per cent in the lieut.-commander grade, 30 per cent in the lieutenant grade, 25 per cent in the lieutenant (junior grade) grade, and, in the engineer corps, 20 per cent in the ensign grade.

This would put the "working" class of the engineer corps necessary for our standard fleet, at 50 of the rank of lieut.-commander, 71 of the rank of lieutenant, 88 of the rank of lieutenant (junior grade), and 48 of the rank of ensign. To this should be added the proportionate numbers in the grades of the "command" class for the higher duties on shore and for fleet staffs, or 1 chief of the corps, with the rank of rear-admiral, 15 chief engineers with the rank of captain, and 25 with the rank of commander.

In the same way, the corps of surgeons would be 1 surgeon-general with the rank of rear-admiral, 15 medical directors with the rank of captain, 25 medical inspectors with the rank of commander, 82 surgeons with the rank of lieut.-commander, 71 surgeons with the rank of lieutenant, and 75 assistants with the rank of lieutenant (junior grade).

In regard to the pay corps, the duties of the "command" class are almost exclusively shore duties, as in case of surgeons and engineers. In the sea-going "working" class, the number required afloat will average about double those required on shore; and therefore about 33⅓ per cent above sea requirements should be provided in this class. Hence the pay corps of the standard fleet would call for 45 paymasters, rank of lieut.-commander, 60 paymasters, rank of lieutenant, 30 assistants, rank of lieutenant (junior grade), and 30 assistants with the rank of ensign. To these should be added the proportionate number in the higher grades, or 1 paymaster-general, rank of rear-admiral, 15 pay directors, rank of captain, and 20 pay inspectors, rank of commander.

Thus, to efficiently maintain in fighting condition the standard fleet that has been selected for discussion, the Navy Register should contain the following numbers of officers of the various corps and grades:

	R. Adml.	Capts.	Comdrs.	Lt. Comdrs.	Lieuts.	Lt. (J. G.)	Ensigns.	Total.
Line	20	100	120	184	467	318	456	1665
Engineers ..	1	15	25	50	71	88	48	298
Surgeons ..	1	15	25	82	71	75		269
Paymrs. ...	1	15	20	45	60	30	30	201

In the table just given the numbers in the various grades of all corps are proportioned to the duties to be performed for what may be called a 20-battleship organization; and as the Navy increases beyond this, the same relative proportions of grades should hold, so that provision for expansion to meet future requirements could be easily made.

It will be noticed that in the battleship and first-class cruiser classes, one commissioned officer is required for about every 500 tons of displacement. In the gunboat and destroyer classes, one is required for about every 100 tons of displacement. As the number of small vessels is necessarily much greater than of large ones, the average displacement in the composite fleet, per commissioned officer, is about 225 tons. Therefore, to meet the needs of a growing service, it would be a simple matter, in drawing the law organizing the naval personnel, to authorize an increase of one commissioned officer for every 225 tons of displacement provided for, over and above any tonnage worn out and laid aside in the same period, the increase to be distributed throughout the Navy list, so as to preserve the relative proportions of the grades as given in the above table.

Something of the number of warrant officers required has already been indicated in some of the foregoing lines; but space does not permit of entering into the details of this branch of the service, nor of the non-sea-going construction corps, though any complete scheme of organization should include all branches of the service.

The space limit fixed for himself by the writer has already been considerably exceeded; but even the briefest discussion of naval organization would be manifestly incomplete without some suggestions in regard to the maintenance of a continuous flow of promotion, and the regulation of the service to make the duty fit the age and rank of the officer.

Anyone with 20 years of service experience can recall to mind frequent incidents where somewhat elderly gentlemen were per-

forming the duties of youth, and young men those of boys. Many other incidents can be recalled where a too long training in subordination without responsibility had unfitted the officer for the active responsibilities of command when that grade was finally reached; and it is no infrequent occurrence to find most excellent subordinate officers in the service deprived by their training of all the independent initiative necessary for efficient offensive action in time of war.

There are, of course, some men whom no vitiating systems or circumstances can crush, and the Navy happily possesses many of these. But the majority of naval officers belong to the average of mankind, on whom training, custom and habit exert an overpowering influence. Therefore, the organization should be such that the training in command and responsibility should begin before youth and ambition are dead; and a system that puts a premium on mediocrity and teaches men to obey well but command ill cannot be abandoned too soon.

The only remedy for this—perhaps the greatest evil under which the Navy suffers to-day—is to organize the personnel in such a way that the age of each grade fits its duties.

To accomplish a reform so sweeping, and one that will affect the private interests of every individual in the service, one way or another, will be exceedingly difficult; but with one so necessary, private interests should not be allowed to stand in the way, and "the good of the service" alone should be the guiding spirit of both the Navy and the law-makers.

Some attempt was made to grapple with this evil in one of the few living clauses of the "Navy Personnel Act," establishing a reasonable flow of promotion. But the reform did not go deep enough to reach the root of the evil. The one and only way to eradicate it forever is to establish an age limit in grade, for the fitting of age to rank and duty. An ensign over 25, a junior lieutenant over 30, a lieutenant over 40, a lieut.-commander over 45, a commander over 50 are all anomalies when any thought whatever is given to the duties of the grades.

In accomplishing so sweeping a reform as is here advocated, and especially in view of the condition into which the Navy list has been allowed to drift in the course of years, through no fault of the individuals borne thereon, all the consideration possible, consistent with "the good of the service," should be given to

those individuals; and it would be well to extend the accomplishment of the reform over a limited number of years. But this period should not extend beyond five years at the most, and with a reasonable increase in personnel, so loudly called for by the enormous increase already authorized in materiel, and reasonable retirement laws, the reform could be accomplished almost immediately with injustice to few, if any, of those now borne on the Navy list.

The writer knows full well that this proposition, to establish an age limit in grades, is almost as old as the Navy itself, and that he has stated nothing new in his remarks. But the question will recur again and again as long as the Navy lasts, or until it is incorporated in our system as the only logical and reasonable solution of the present and past most unsatisfactory conditions.

One other proposition almost as old and quite as hackneyed, yet equally important, that should undoubtedly be incorporated in any system of naval organization, is the promotion to flag rank by selection. This has been fought over so often that little new can be said on the subject, yet a few remarks will be attempted.

Speaking on this subject some years ago with an English post-captain, whose chances of further promotion had passed, the writer asked the captain if he felt no bitterness and discontent at being thus passed by. The answer of the English captain was a model that did credit to himself and to the system under which he had been trained, and his spirit might well be emulated in our own service. He said, "No. Naturally, I would have loved to have been promoted, but there were *better men*, and *it is all for the good of the service*."

The reply of this English captain would seem to condense the whole matter in a nutshell. If there are *better men* "the good of the service" requires that they shall be selected. As a matter of fact, in case of war this is what is always done, without giving the officer selected the actual rank and position on the Navy list to which the responsibilities and duties to which he is called justly entitle him. This is manifestly unjust to the officer concerned and to the whole service. It places him often in equivocal positions in connection with officers his seniors on the Navy list, and leaves it to his personality to produce the results that should

flow from actual rank. Few will be found bold enough to maintain that all men are born natural commanders-in-chief. Yet that is the assumption on which our system is founded; and when the necessities of war compel a departure from so illogical a system the work and responsibilities are carried by the selected few, and the rank and rewards go to all. As a matter of reason, of logic, or of justice, the argument is unanswerable that to those who do the work and carry the responsibility should come the rank and the rewards. Yet our system is contrary to all this, and takes from every individual in the service one of the greatest of human incentives to strive for the attainment of excellence.

The reason of the Navy's being is war, and war only; and a system that will not stand the test of war should be swept aside forever. Admirals are designed primarily to command fleets in time of war, and no one has a right to that proud title whom the Department would hesitate for an instant to send to sea in command of a fleet to meet the enemy.

Undoubtedly, by any system of selection that would be adopted, some errors and injustice to individuals would be unavoidable, however fair-minded the selectors might strive to be. But almost any system, however faulty, would produce better results, on the whole, than the present plan; and the experience of both the war of the Rebellion and the late Spanish war would seem to prove that selection, handicapped as it was by the present laws, was eminently successful.

Let our motto be, the country first, the service next, and the individual last, and reforms will adjust themselves, and the service become as near its design as human nature permits.

DISCUSSION.

Captain F. E. CHADWICK, U. S. N.—I wish first to thank Lieutenant Hood for a most thoughtful, able and philosophic paper. It is a subject over which I have addled my own brains sufficiently to know its difficulties, and to enable me to know something of the study and labor of which this is the evidence. The organization of administration has always been a weak point in our system, and it has been weakest where, by the complex nature of the subject, it should be strongest—in the navy. Nothing could be more haphazard, disconnected, and, so to speak, off-hand, than the law establishing our present organization. Within this law, by the one saving clause enabling the secretary to

establish the distribution of business, we have been slowly working towards some of the views which Lieutenant Hood advances. We thus finally have a Bureau of Personnel in our now misnamed Bureau of Navigation, which is wholly a military bureau; a startling instance of the slowness with which we move, as it has taken us more than a hundred years to arrive there; we have yet to take the next great step.

I agree, in the main, most cordially with the author's views. In a paper I wrote on the subject and published in the PROCEEDINGS OF THE NAVAL INSTITUTE, I took somewhat similar ground, but have seen reason since to alter some of my views, but I would say that this alteration has been almost wholly in the direction of those now expressed by the author. I think, however, that the head of the personnel should be also chief of the general staff; Mr. Hood subordinates the latter to this head, so that it works out somewhat the same, but I think it better that there should be no separation.

In 1894 I advocated a separate chief of staff, but I expressly stated my change of view on this subject in a letter to the department in 1899. I think the genius of our race demands fewer divisions of responsibility. Such a separation will work in Germany or France but not in America or England. The latter country has certainly evolved a most admirable working system and in this the head of the office of personnel is practically chief of the general staff and the military head of the service. Of course, in the system advocated, the head of the personnel should be relieved of much of the minor labor now devolving upon him; but that is a mere question of detail.

I think the assistant secretary should be the coordinator of bureaus of material advocated in the paper. The coordination could be arranged for either by his acting as the correlator directly of all the bureaus of material (including supply and works) or by having an intervening official to bring together the threads of the Bureaus of Ordnance, Construction, Steam Engineering and Equipment, and the other bureaus mentioned to have more direct relations with the assistant secretary. If the burden of work were not too great, it might possibly perhaps be better to dispense with the intermediate official over the four special technical bureaus, on the general principle of making responsibility as direct as possible; the question is too large to determine otherwise than by trial.

It must be remembered that intimately combined with all this is the navy yard administration; the questions of purchase, responsibility, distribution and account of stores and material, are all matters of great importance and of a difficulty which can hardly be exaggerated. If a new organization were to be, it would perhaps be best to begin with the fewest wheels possible and add as necessity demands. We have, on these points, the English service with its colossal mine of experience to which I would again hark back as an exemplar to be closely studied and followed as much as may be in filling out the details of the system which Lieutenant Hood has broadly and so ably sketched.

I cannot enter upon the subject of the second part of Mr. Hood's paper

to any great extent except to say that I think his views are, in the main, sound, except that I must say that I do not think we are in a position to dogmatize about the engineer. The exact relation of the engineer officer to the rest of the ship's hierarchy, in case of a separate corps of commissioned officers, must be recognized as a most difficult problem. The present arrangement undoubtedly solves much. I have always contended that the same man who was good enough to stand the engine-room watches, say in the Campania, is good enough to stand the watches in our own engine-rooms. But there must be immediately over these and the large body of men connected with the engineering force, a directive authority of a higher type and of a much higher rank for disciplinary and general directive purposes. It remains to be seen how our present arrangement will work. I am inclined to think it will adjust itself. It is a great experiment, which, if successful, will give us the immense advantage of greater homogeneity. Where there are 200 men to be looked after in a military organization, rank is a necessity. It carries a weight and influence which ages of experience have shown to be part and parcel of mere official position. Our American life rather causes us, in a general way, to rebel at the idea; but there are certain entities and fixities which are common to all mankind, and of which we cannot rid ourselves any more than we can of our race temperament, and the power which rank carries is one of these; I believe that any well-trained naval officer should be capable of this general direction.

While mentioning the subject of rank, I would say that I hope the day will come when we may recognize another fact, that is, that with perfect propriety and without derogation from the dignity of rank, the same rank may have many titles; that a captain or a medical director in the navy and a colonel in the army are equally well thought of and rank in the same plane despite their dissimilarity of titles. Title is one thing, rank is another; and while rank is of fundamental importance, title is only a matter of convenience. I hope that by the time Mr. Hood shall be successful in his reorganization our country shall be thoroughly imbued with the wholesome and self-respecting habit of thought which shall cause any public officer to insist upon being known for what he is and never for what he is not.

Captain CASPAR F. GOODRICH, U. S. N.—The essayist is quite right when he says that "there has been no fixed naval policy, nor any logical, consecutive system of development," but I am not sure that he is equally right when he describes the present "spirit of following the law of expediency" as "founded on the moral weaknesses of some, the personal ambitions and jealousies of others, and the want of foresight and ideas of false economy of all." Some measure of truth there may be in this indictment. The influences he cites are, however, essentially human, and they must be expected to exist in any human undertaking, to a less or a greater degree, according to the skill and wisdom of its designers. If these influences were made apparent under the essayists' analysis, he could certainly do no less than point them out and, at the

same time, indicate a means to their elimination. When things human are beyond improvement, they have already become divine. It will always be a healthy sign that members of the naval service seek for better things.

Personally, I am disposed to attribute our lack of a naval policy to our still more notable lack of a national policy. Without the latter it were idle to expect the former. Out of the nebulousness of the past there seems to be gradually shaping itself a scheme of national development affecting naval affairs in their turn and demanding the adoption of the best and most economical methods in order to achieve the desired results. The time is ripe for discussing the subject which the essayist states that he has selected, but which, I fancy, is less a choice on his part than forced upon him by his interest in and study of his profession.

An old officer once said to me that the bureau system was not so bad in itself, but that the Navy Department needed some office, or officer or commission, to knock together the heads of the bureau chiefs and make them agree. This idea would appear to have been in the essayist's mind as he wrote. The bureaus were originally intended to divide the navy's civil business among them and so relieve the secretary of much of the burden of his financial and other responsibilities. To-day, the bureau chiefs are so overwhelmed with the minutiæ of their several charges that they can not properly give sufficient time to the consideration of those broad questions which concern the service as a whole. The essayist's plan may not meet with universal acceptance, but it offers at least a well-reasoned means of reaching an end which is generally conceded to be greatly needed. It can not, therefore, be lightly rejected except by those who propose something in its place which shall be evidently and distinctly better. Much that he desires can be accomplished without legislation. I should suppose that the secretary would welcome a method by which he could secure unprejudiced and responsible advice from capable and chosen officers on matters of policy, types of ships, naval wants, etc. Of the General Board much was expected and by it much may have been accomplished, but a smaller body of advisers, composed of officers stationed at the department and meeting frequently, if not daily, would yield good fruit in continuity of thought and purpose, as well as in acting as a balance-wheel upon undue zeal or self-centered projects. The essayist provides, in a manner, for such a commission in his " Boards on Policy and Naval Strategy " and in his " Permanent Board on Construction." His proposition is, however, open to the serious criticism, as I view it, of combining in one set of men the unrelated, if not mutually antagonistic, functions of counsel and execution.

On the other hand, to combine all that concerns the personnel under one head and all that concerns the material under another head must commend itself to the judgment. For that feature of this essay I have only praise to offer.

Much of the difficulty now experienced in designing ships, for example, and the regrettable multitude of widely different patterns all bearing the

same label, would be avoided by committing to his Board on Policy and Naval Strategy (or, as I should prefer, a separate body of counsellors) the responsibility for general characteristics—types, in short—leaving the details to be worked out by the Board on Construction.

What a ship should be is a purely tactical question and should be settled by tactical experts. How to achieve this result is the province of the designer. Once the leading traits of the proposed new vessel are fixed, the essayist's plan of combining all the various branches of construction, engineering, ordnance and equipment under one control would work satisfactorily, promptly and economically to an extent which we can neither doubt nor foresee.

The essayist's proposition, in creating a division of material to abolish the bureau of yards and docks, is so manifestly business-like as to demand little passing comment, and to challenge no serious adverse criticism.

Possibly the essayist is correct in his strictures on the "Personnel Act," but I think it only fair to hold our judgment in suspense until more facts and a wider experience have been gained. Should time develop the evils which he prophesies, the establishment of a corps of real engineers of the highest possible attainments and efficiency would be in order. I have always been of the opinion that there is a broad, natural and impassable gulf dividing the naval engineer and the marine engine-driver, as I have always deprecated the use of the razor to do the work of the broad axe.

What the essayist says of the corps of professors of mathematics and that of civil engineers admits of little or no contradiction. In the minds of many, it is an open question whether even our constructors should form a commissioned corps in the navy, believing that the navy should contain no officers who do not go to sea. I mention this fact, not to raise a new issue, but to show that the essayist is not so radical as he might have been.

The paramount necessity of drawing upon the Naval Academy for all officers, except chaplains and surgeons, is well stated. But why should the paymasters be a separate corps? Why not detail officers from the line for this purpose?

As the number of ships in his standard fleet is a mere preliminary assumption necessary to determine the total number of officers required, I offer no comment beyond recording a doubt as to the readiness of Congress to provide so large a personnel. After all, it is ratios which are sought rather than concrete numbers.

Eventually, of course, we must come to an "age for grade" retirement. It does no harm to return again and again to this point, but such a measure must be accompanied by selection in the lower grades, otherwise men who enter the Naval Academy at the upper limit of age could never hope to reach command rank. If they possess the requisite ability, they should have a chance to pull ahead.

The proposition to introduce selection to the grade of rear admiral will find little favor in the service at large. The English system, which

he quotes, is far better, in that it selects only so far as the list of captains. But, as Kipling says, "That is another story." Strictly speaking, the matter of promotion is not germane to the subject of the essay. There is neither time nor space to deal with so vast a topic in the essay or in this brief discussion.

It will be perceived from what I have said, that, in the main, I agree with the views of the essayist, our only important difference lying in my doubt as to the desirability of placing upon certain administrative officers the further and contradictory responsibility of counsel.

In conclusion, I can not refrain from speaking of the happy, forcible and excellent style which crowns this admirable essay with unusual and notable literary merit.

Commander RICHARD WAINWRIGHT, U. S. Navy.—The essayist certainly has selected a broad and comprehensive subject, and one on which there may be many differing opinions. To my mind he has treated the subject in a masterly manner, and his essay must assist in strengthening the influence of the Naval Institute.

From the fact that the navy has been expanding rapidly and constantly, it may be inferred that there is necessarily a want of crystallization of methods, and that much is a mere adaptation of means to ends. One rarely sees a logical, consecutive system of development in human affairs. Certainly our railroads, our great factories, our navy, present no such system of development. What was logical in one stage of development may have become illogical in another, when further knowledge brings more light on the subject.

That we have been fairly successful in comparison with other navies must be admitted, and it seems reasonable to look for something besides the ability of the administrators, something within the organization, to account for this success.

With all its faults the bureau system has been successful, and to my mind the living cause of this success is the frequent change in the chiefs of bureaus. Coming fresh from the general service to administrative duty, a chief must know the needs of the service and must realize that what he creates to-day he may use to-morrow, and that he must benefit or suffer by the regulations he puts in force.

The most serious fault of the present bureau system is that it permits some chiefs to remain too long in office and thus gives undue influence to some branches. A man-of-war is a mass of compromises, and a chief of bureau can only reach the highest possible efficiency in his branch by strongly urging his own portion of the work. While to have one head of all the bureaus would save some contention before the secretary, yet this new chief must harmonize the efforts of his subordinates.

The principal faults in the present bureau system to my mind arise from the manner in which the appropriations are made, and is manifested largely in the conduct of our navy yards and in the purchase of supplies. The commandants of our yards should be the actual heads of the establishments and not, as now, the moderators or nominal heads

of a number of subheads, representatives of the different bureaus. The money for the maintenance of the navy should be appropriated in a lump sum and allotted to the navy yards for specific work, not distributed among the various bureaus. This is too large a subject to more than mention in a criticism.

My principal objection to a chief of material is that once in four years, he would become a permanent head and he would lose the great advantage of close contact with service interests.

A chief of personnel is a good idea; it rounds out and strengthens the duties of the present Chief of Bureau of Navigation; but he should be the chief of the general staff.

While the office of the Judge Advocate General should be placed under the chief of personnel, many of the present duties of the Judge Advocate General should be removed from his office and placed under the assistant secretary, such as all matters of contracts and points of law not purely military.

I disagree entirely with the writer's remarks on the Personnel Bill. It is "plainly apparent" to me that the few men that have heretofore designed our machinery were not made by our old system, but in spite of it. To me the "logic of events" that have passed predicts success for the future. The men who have designed steam engines, turret and electric machinery of all kinds, are all engineers. I cannot see why engineering should stop at the entrance to the turret-chamber or to the dynamo room. Designing engineers will be selected without difficulty from the large body of the new line, who will have about the same early training as the old engineers, and will have almost as much experience with machines, and who will not have their intellect dulled by standing cold iron watches or making tidal observations in the bilge.

The increase of officers as urged by the essayist is most important to the navy, and as the only reasonable way to obtain this increase is through the Naval Academy, additional appointments to that institution should be urged upon Congress. It will be necessary to dispel the growing impression that the Naval Academy is an aristocratic institution, and to point out the fact that it is the most democratic institution in the world, admitting boys from all classes and making scholarship and aptitude the only criterion for standing in the service. Certainly learning is not the usual badge of aristocracy, and it has never been democratic to reward ignorance with high rank.

Professor P. R. ALGER, U. S. N.—I think that, in the long run, the essayist's plan of interposing a "chief of material" between the Secretary of the Navy and the Bureaus of Construction, Engineering, Ordnance, Equipment, and Supplies and Accounts, would do more harm than good. The present "Board on Construction" is a very efficient instrument, and the frequent disagreements of its members are always in regard to matters properly open to a difference of opinion and the discussion of which is desirable. If it were possible, which it never will be while there

is a Secretary of the Navy, to give to a single officer the deciding voice in all questions regarding material, disputed points might possibly be sooner decided than they now are, but only at the expense of less careful consideration. The Secretary of the Navy had far better accept the finding of a majority of the Board on Construction than allow any individual to set aside their opinion, and especially so since a divided board can always be augmented by other officers when matters of great importance are to be decided.

I am still more strongly in disagreement with Lieutenant Hood in his condemnation of the amalgamation of the line and engineer corps. If the "general inefficiency" which he predicts as a result of our present system ever comes, it will, in my opinion, be because that system has not been fairly and honestly tried. Lieutenant Hood says that the younger officers of the line do not as a class wish to take the places of the trained engineers of the old system. But in accordance with his own views, with which I entirely agree, only a limited number of highly trained engineers is needed, so that the younger line officers "as a class" are not required to become trained engineers in the sense in which he uses that expression.

He admits that the line produces its ordnance experts; why cannot it produce its engineering experts? Is it because steam engineering is less agreeable work than ordnance or electrical engineering that Lieutenant Hood fears we shall soon have no specialists left in the former field? Unless he forsakes his own avowed principles, and approves of the sacrifice of the good of the service to individual preferences, he should demand that officers who can become experts in steam engineering be made to devote themselves to that line of work.

Putting aside the moral qualities which are the first essential for a good naval officer, I think that no one can doubt that to be a competent engineer, using the word in a broad sense, is more necessary than anything else for efficient service as a subordinate on a modern man-of-war. If the propelling machinery of a battleship be put on one side, and all her other machinery of every kind on the other, I venture to assert that more engineering knowledge is needed for the proper care and handling of the latter than of the former. If the average line officer is enough of an engineer to have full charge of the torpedoes, ordnance appliances and electric installation, it will require little added engineering knowledge for him to also take charge of the propelling machinery. If, however, it be contended that we need specialists for ordnance, etc., then why should not specialists for steam engineering be developed in the same way out of the line? If line officers are as anxious to become specialists in steam engineering as in ordnance or electrical engineering, then there will be no difficulty in getting a sufficient supply of the former. It should be recognized that until an officer reaches the grade of lieutenant-commander, there is no other one thing so important as that he shall be a thoroughly competent practical engineer, and though steam engineering may be less agreeable to him than some other branches, he must sacrifice his individual feelings to the good of the service.

It is perhaps natural that I should be unwilling to accept Lieutenant Hood's mere dictum that "the present corps of professors of mathematics is a relic of a dead system and is an unnecessary adjunct of the navy." Surely there is some room for argument on this subject. I suppose Lieutenant Hood would favor withdrawing the Naval Observatory from naval control, but if this were done the most important sphere of duty for professors of mathematics would still remain. In my opinion, the heads of all the non-professional departments at the Naval Academy should be permanent, not shifting every two years or so, and the corps of professors of mathematics affords a means of filling these positions with commissioned officers specially selected with a view to their capabilities. The army has its "corps of professors at West Point," ranking with lieutenant-colonel and colonel, and filling the positions of heads of departments, and the navy can, in my judgment, get good service from its corresponding corps of professors of mathematics and should not willingly acquiesce in its abolishment. Do not condemn the instrument because in some hands it has been badly used.

As regards Lieutenant Hood's proposed age for grade limits, it is to be noted that a radical change in the standards of admission to the Naval Academy would be entailed thereby. At present a graduate may be 26 years of age and a considerable number would be retired under Lieutenant Hood's plan before ever being commissioned officers. Even were the upper limit of age of admission to the academy placed where the lower limit now is, at 15 years, making the age of final graduation 21, the requirement that promotion to the grade of junior lieutenant must occur before the age of 25 would make it necessary to provide 114 vacancies each year above the grade of ensign, and this would mean at least 60 compulsory retirements annually. I think it would be much better to only have retiring ages fixed at the two points of promotion to commander and to rear admiral.

Lieutenant S. S. Wood U. S. N.—I take pleasure in seconding the opinion of the Board of Control in deciding that the paper of Lieutenant Hood is worthy of a prize and in assuring him of my hearty approval of his scheme of naval administration and organization. I wish that it might be brought before every officer in the service, and that each would give it the careful thought to which it is entitled, and I feel sure that were it adopted *in toto* the service at large would be much benefited. The scheme in general is excellent, but perhaps some difficulties would be met with in carrying out the details. Still, I cannot believe that they would prove to be insurmountable if undertaken with a sincere desire for the betterment of the service.

May I touch on a few of these details, not in their order of importance perhaps, but in the order in which they are presented in the essay?

I think the division into the Personnel and Materiel as made by the essayist extremely good, but is it really very different from what is now in vogue? Now, the different bureau chiefs report to and confer directly with the secretary; by the new scheme, they would report to

their immediate chief and the secretary instead of having eight advisers to listen to would have only two. Surely the secretary would not object to this; but, would not these two advisers be tempted to call into conference with the secretary the subchief who had gone into the subject more deeply than he had done? I think so, and, as soon as we increase the number of minds to decide upon a certain thing, are we not increasing the labor and, therefore, delaying the progress of the work? Unless each chief has in his own division almost as much authority as the Secretary of the Navy has now, I fear that the transaction of business will not be more rapid than at present.

It seems to me that the two chiefs proposed should hold their offices for four years at least, even if this should carry them beyond the retiring age. I do not advocate that this should be usually practiced, or, if allowed, that it should stop the flow of promotion until the incumbent passes to the retired list. No; let him remain on the active list, but let the others move up as if he had taken his place with those who had retired at the age of 62. The point I am endeavoring to bring out is the advisability, nay, the necessity, of having the chiefs in their positions long enough to shape a policy and prove its utility. If, as the essayist suggests, only those from the highest grade are available for this duty, will we not have an ever-changing chief to look up to? And with these changes will not the service suffer? I think so.

We Americans are inclined to scoff at the conservatism of the English, but does it not seem as if each new chief, like a true American, in his desire to improve existing conditions, introduced too many changes for the good of the system? Would it not be well for us if there were a law which required that every regulation or order issued for the guidance of the service should remain in force for a year or more unless it could be proved that its enforcement inflicted positive injury to individuals or great loss to the Government? It is undoubtedly a good thing to be able to change existing orders, but if it were known that when once issued they must stand long enough to be securely tested would not more care be exercised in promulgating them?

As to the necessity of having an engineer corps in the navy there never has been any question in my mind. They may be given line titles, but their duties must still be performed and well performed, too, or our ships soon become useless and broken down. Surely the practice which has proved economical and advantageous in the merchant service could be applied with even more force to our modern ship of war. Let our highly educated officers superintend and be ready for an emergency, but let the engine-drivers perform the daily and hourly watch duty. Thus from knowing the actual needs of the ship at sea will he become better able to design the machinery for others.

By all means make this division before the cadet leaves the Naval Academy; make no distinction other than ability and aptitude, and then proceed to develop along the lines chosen for them by the Academic Board.

I am heartily in accord with Lieutenant Hood in his remarks about

the necessity of having all branches of the service, with the exception of the surgeons and chaplains, drawn from the Naval Academy. Much of the severe criticism often heard in the ward-room upon the acts of the commanding officer would thus be avoided; for many, by their course at the academy, would learn the first principles of military discipline, and knowing them while young, might carry it out by their example and teaching later in life. Of course there will always be growling, but the wholesale condemnation of orders, acts or decisions of superior officers should never be permitted.

I am also ready to place myself on record as being in favor of promotion to flag rank by selection. There are abundant arguments in favor, and the few opposed to it ought not to be allowed to stand in the way of the good of the service.

We can only perfect our service by a hearty cooperation of all of its members, each one striving to do his best; and surely this is a favorable opportunity to try and learn the opinion of the members on this fundamental thing—its organization and administration. I wish that the Institute could get an expression of opinion from every officer of the service, and then perhaps we would be willing to abide by the decision of the majority.

I desire in closing to thank the essayist for the excellent thoughts which he has suggested and to express a wish that his plan will some day be adopted and carried into effect.

Lieutenant L. H. CHANDLER, U. S. N.—In reading this most excellent essay I find myself in hearty accord with the essayist's views as far as the question of administration is concerned, and I believe that such an arrangement as he describes would, in general, prove an ideal one.

There are, however, one or two points in that part of the essay which treats of organization upon which I desire to touch.

The first of these is the judgment passed by the essayist on the working of the present system of organization of the line of the navy as created by the Personnel Bill of 1899. This bill amalgamated the old line and engineer corps, and against this one particular feature much adverse criticism has recently been launched, in many cases by those who favored the amalgamation at the time the bill was under discussion. The claim against the amalgamation is that it has taken away from us our corps of trained engineers and given us nothing in its place.

By the amalgamation, as provided by the Personnel Bill, two things were to be accomplished, the first being to bring together into one new corps all living officers of the two old corps, and the second, to educate for the future a class of officers who would be able to do the duties of both corps. Only to a very limited extent was it intended to transform the old engineer into a line officer except in cases where the youth of the said officer was supposed to render it possible. All this is ancient history to every one, but I have repeated it here merely to give point to the remarks that follow:

There are in the navy to-day exactly the same number of the old

engineer officers that would have been to-day in the old engineer corps had it continued to exist, and out of this number there are one lieutenant-commander, twenty-eight lieutenants, thirty lieutenants of the junior grade and eleven ensigns, a total of seventy in all (Navy Register, January 1, 1901), who are, from choice or by law, doing line duty to qualify themselves for duty in the new line. In other words, the Personnel Bill has resulted in the temporary withdrawal from engineering duty of but seventy of the old engineer officers. I say temporary, because after they qualify for the line, these officers will take engineering duty in the same proportion that other line officers should.

The question arises at once as to why these seventy engineer officers have not been replaced by other competent officers of the line, if indeed they have really not been so replaced. Is it because seventy officers of the old line competent to do daily routine engineering duty aboard ships with simple machinery could not be found? I deny that this is the case, and I do not believe the essayist will claim that it is. In fact, a considerable number of old line officers have been so ordered as engineers and have performed their duties with ability.

The truth of the matter is that at the time of the passage of the Personnel Bill the navy had just been enormously enlarged, and it has remained so enlarged ever since. Had the Personnel Bill never been passed, we should to-day have exactly the same outcry for more engineer officers that we have under the present system, and the need would be just as great. The demand for more line officers is to-day just as great, if not greater, than that for more engineers, and it would be just as correct to charge the present shortage of line officers caused by the expansion of the navy to the workings of the Personnel Bill because some officers of the old line have been given engineering duties, as it is to charge upon that measure the present strong need for engineer officers caused by the same enlargement because seventy engineers are now performing line duty.

In other words, I deny that the amalgamation has reduced the number of competent engineer officers available, and assert that the present cry for more engineers is caused exclusively by the same reasons that have brought about the present great scarcity of sea-going officers of both branches.

The law never was intended to make a man who was already only an engineer into a line officer, or vice versa, merely by its enactment, and nobody ever claimed that it would do so, yet to-day it is judged, and most unjustly so, by its failure to do that very thing. A certain number of old line officers are learning to be engineers, and a certain number of old engineers are learning to be line officers, and if there are not enough men available in each branch, as there are not, the shortages are due only to the small total number of officers of the new line available, and not to the shifting of duties. The department has at its disposal to-day a certain number of line officers available, and in assigning them to duty a certain proportion go to each branch of the service. Because the actual number thereof assigned to engineering is not enough the Per-

sonnel Bill is blamed, but in my opinion the chief of the Bureau of Ordnance might as justly claim that, because he is short of inspectors and has to leave important work to civilian subinspectors, who have in many cases proved incompetent, therefore he ought to be given a separate corps of officers to do his work, and his work only. I am confident that, could we get a sufficiently great total number of officers in the line of the navy so that each branch of work could have a proper number of units assigned to it, then the shifting of these units from one branch to the other according to their adaptability would become a comparatively easy matter, and we would find the now ever-increasing complaints against the amalgamation feature of the Personnel Bill dying away to nothing.

I believe that this would be true even with the present officers, who have not been specially brought up to meet the conditions of to-day were there only enough of them. I have confidence enough in the ability of my brother officers to believe that in that case, while each man could not become thoroughly expert in every branch, still, when an expert was needed in any particular subject, it would not be difficult to lay hands on him. It is hardly more difficult now to find an *expert* for a particular duty than it is to find *anyone, expert or not.* As well condemn the present system because every man in the line is not competent to do the design work for the Bureau of Ordnance, as because everyone is not a competent designing engineer.

Being possessed of the abiding faith above set forth, that if the total were only large enough the subdivisions would arrange themselves, even when the total is made up of officers raised under the old system, I am still more confident that, by the time the officers of the navy are all men who have been educated for the present conditions, the new line as a whole would be most thoroughly and efficiently competent to perform all the duties, line and engineering, that would by right to it belong. There would still be the occasional square peg in the round hole, of course, as will occur under any system, but with a large number of pegs and holes to manipulate, the necessity for putting the two misfits together would be less likely to occur than under the old system.

Again, again, and *again,* the crying need of the navy is for more graduates from the Naval Academy each year! Let every man bestir himself to bring about an increase in the number of appointments to the Naval Academy, and when success has been attained to a sufficient degree to give the total that is needed, the evils of amalgamation will never be heard of again.

Having said my say in regard to the criticism by the essayist of the amalgamation feature of the Personnel Bill, I will state what I believe to be the proper organization of the line, following as much as possible Lieutenant Hood's method of expression.

I would have a line of sufficient total numbers, not as to-day, with one thousand men to fill two thousand places. No system can make one man into two. This, of course, Congress must be induced to provide, and as long as it is not so provided no system will produce good results.

Then each line officer should be aided by the department as much as possible in developing his particular faculties in certain directions. A man who proves himself a thoroughly competent engineer, ordnance officer, electrician, torpedo officer, etc., by passing appropriate *rigid practical* examinations, not such as come before promotion, should be so designated in the Navy Register. Then, aboard ship and ashore, the officers who are fit for certain duties should be given them to perform, regardless of their rank, that fetich that says that number three on the list of a ship's officers shall run the dynamos whether he can do it or not.

Every officer who graduates from the Naval Academy can, as far as human nature renders it possible to make such a statement, learn to perform the daily duties of the turret, deck and engine-room equally well, and can give satisfaction in the performance of them all. In so doing the younger officer will find himself naturally attracted in a particular direction, and a desire to be known as a qualified specialist will, in nine cases out of ten, lead him to become expert in one or even more of the special branches without losing general efficiency thereby. The tenth man who feels no special interest in anything is the man who should be used to stimulate promotion by prompt action on the part of the examining board. There is no room for him in the navy.

This would provide for Lieutenant Hood his "highest class of engineers," "one for gunboats and smaller cruisers, two for cruisers second class, and three for cruisers of the first class and battleships." I quite agree with him that "any greater number of engineers of the highest class aboard ship is superfluous, and therefore useless. For engineering work under them, the present system of warrant machinists, and machinists of the various classes, supplies just the order of material needed for the work to be performed." I claim that under the system I propose the line officer can do all that is required.

I desire to paraphrase the above quoted sections of the essay as follows:

"But the need of the very highest class of ordnance experts on board ship in the numbers corresponding to the duties to be performed is more crying now than at any time in the previous history of the navy; and that need will become more and more urgent as the navy expands, and ordnance and ordnance devices increase and multiply. And while it will be absurd to use highly trained and educated designing and constructing ordnance experts for training and elevating levermen, ammunition hoist operators, torpedo manipulators, etc., one or more, according to the size and arrangement of the armament, should be on all ships of the navy as officers in charge of the different sections of the armament and superintendents of its machinery, and should be held responsible for the proper working and efficiency of all the mechanical features of the armament.

"For this purpose one would be needed for each different section of the armament, whatever the kind of ship. Any greater number of ordnance experts of the highest class aboard ship is superfluous and therefore useless. For the ordnance work under them, the present system

of gunners, gunners' mates of the various classes, and gun captains, supplies just the order of material needed for the work to be performed."

A similar reading may be given relative to the electrical force, and can anyone deny that the argument rolls out just as smoothly for ordnance and electricity as it does for engineering? I can see no just ground for any such denial.

Such being the case, the conclusion to be reached is obvious. If Lieutenant Hood's argument is sound for engineers it is sound for the other specialists, and we must have an electrical corps of commissioned officers and an ordnance corps of commissioned officers. Why does he neglect to provide these special commissioned corps of Naval Academy graduates for ordnance and electricity when he does so for steam engineering and even for the keeping of pay accounts?

I believe in a line of the navy each member of which shall be able to perform efficiently the daily duties of the ship of all branches, on deck and in the engine-room, and the care and handling of turrets, guns, machinery and torpedoes, the caring for and running of dynamos and motors, and even, iconoclastic as it may seem, the handling of the accounts of the pay as well as of all other departments. Then let each man seek his bent in designing engineering, one or more branches, and with the system of warrant and petty officers now in existence I believe we would have the finest organization in the world.

We now lack officers and we lack all classes of petty officers, and our present troubles spring far more from this than from the system. Get them, and I believe the system I have herein sketched out would give us everything that could be desired.

Leaving personnel and coming to material, I assume that Lieutenant Hood only takes his one hundred and fifty vessel standard fleet for purposes of argument, as otherwise I do not agree with his proportions. For instance, forty gunboats and twenty small cruisers will never be sufficient to perform the police work of a great world-power as we must become. That fleet and more would be kept busy in the Philippines alone all the time, were the heavy ships retired from that kind of work there, as they would be if it could possibly be done. I also trust our battleship development will not stop at twenty.

Also forty torpedo vessels are altogether too few, if they are to be used consistently for coast defense, as I believe they should be. From one hundred and fifty to two hundred would give a very good coast-defense flotilla, and it may be noted that England and France, each with far less coast-line than we have, have well up to those numbers of these vessels.

I also believe Lieutenant Hood's estimate of the number of officers that are needed aboard ship is altogether too low, and in regard to this I cannot do better than incorporate in my remarks a statement which I drafted, in conjunction with Lieutenant-Commander Vreeland, for the use of the line committee. This paper was afterwards submitted to the Senate by Senator Hale, and was printed (Senate Document No. 145, 56th Congress, 2d session), and referred to the Senate Naval Committee

for its use. It covers the present need for line officers more fully, including a statement of the number of officers necessary for manning a battleship. It will be noted that Lieutenant Hood's estimate in regard to the proper commissioned personnel for a battleship is lower than that of the chief of the Bureau of Navigation, which is in turn below that of the pamphlet. I believe that the pamphlet estimate is a minimum for the efficient service of a battleship, and that Lieutenant Hood's estimates for other classes of ships are low in proportion.

The pamphlet referred to is as follows:

"A STATEMENT OF THE PRESENT NEED OF THE NAVY FOR ADDITIONAL LINE OFFICERS BELOW THE GRADE OF LIEUTENANT-COMMANDER, WITH A PROPOSED REMEDY THEREFOR AND AN ARGUMENT IN ITS FAVOR.

"Compiled from letters to Congress from the Secretary of the Navy and the Chief of the Bureau of Navigation, and from other sources.

"*January* 23, 1901.

"1. Owing to an omission, and not through any error, the Navy Personnel Act of March 3, 1899, has failed in one important respect to accomplish what was intended, for while it authorized an increase in the number of commissioned officers of the line (total of old line and engineer corps) it failed to carry with it any measure providing for the supply of graduates from the Naval Academy to fill vacancies then existing and to come.

"2. As a partial remedy this Congress, in the spring of 1900, somewhat increased the number of cadets at the Naval Academy, giving to each Congressman the right to maintain one cadet *at the Academy*, instead of holding up a Congressman's appointment until his cadet had finished his six-year cruise, as had been the rule prior to that time.

"3. On January 1, 1901, there were 138 vacancies at the foot of the list of Ensigns. Adding to this the vacancies for the present fiscal year as laid down in the Personnel Act, and we have that—

"4. The number of vacancies at the foot of the Ensigns' list on June 30, 1901, is 178, the number of vacancies at the foot of the list in each year being at least 40.

"5. The following table will show the effect of the operation of the present law towards filling these vacancies:

Fiscal year ending—	Vacancies at end of year.	Graduates to fill them.	Vacancies left unfilled at end of year.
June 30, 1901	178	52	126
June 30, 1902	166	59	107
June 30, 1903	147	67	80
June 30, 1904	120	60 (*a*)	60
June 30, 1905	100	45 (*b*)	55
June 30, 1906	95	68 (*c*)	27

(*a*) Present second class at Academy; strength on January 1, 1901, is 65.
(*b*) Present third class at Academy; strength on January 1, 1901, is 55.
(*c*) Present fourth class at Academy; strength on January 1, 1901, is 93.

"6. This table brings the calculation down to the time when all the cadets now present at the Academy shall have been commissioned, that is, to July 1, 1906.

"7. Under the old law there were about 31 graduates a year available to fill vacancies in the line, which multiplied by ¾ to allow for change in law of last year, will give as a future average about 47 graduates a year to fill vacancies in the line, or an excess of 7 appointments as Ensigns over the year vacancies.

"8. Therefore the 27 vacancies existing on June 30, 1906, would not be filled under the present law until four years later, or June 30, 1910.

"9. The above calculation considers only the number of line officers as allowed by present law. Passing from the line as at present constituted, let us take up the actual need of the navy for officers.

"10. Taking the Indiana as a type of battleship, and considering the number of officers needed to fight her battery effectively, we would have as follows:

1 Commanding officer.
1 Executive officer.
1 Chief engineer.
1 Navigating officer.
4 13-inch turret officers.
4 8-inch turret officers.
2 Main-deck battery officers.
2 Secondary battery officers.
4 Powder division officers.
4 Assistants to chief engineer.
1 Torpedo officer.

25 in all.

"11. Considering the grades of the above officers, we should have for this ship:

1 Captain, in command.
2 Lieutenant Commanders, as executive and as chief engineer or navigator.
7 Lieutenants and Lieutenants Junior Grade, as chief engineer or navigator and 6 watch and division officers.
15 Lieutenants Junior Grade, Ensigns or Naval Cadets, as officers of divisions, junior officers of divisions, assistants to chief engineer, etc.

25 in all.

"12. It is impossible to obtain the highest efficiency from the Indiana with fewer officers than the above, and every officer of rank in the navy who has had battleship experience will testify to that fact.

"13. In his letter No. 244,772 of December 10, 1900, to the Chairman of the House Naval Committee, the Chief of the Bureau of Navigation has stated that the Indiana should have 17 officers. This means that by

cutting to the lowest possible limit, to an extent really unsafe in time of war, the ship can be kept going with that number. In other words, the estimates in that letter are the very lowest possible, without any factor of safety or allowance for casualties, and would leave large and important sections of the battery to go into action without the supervision of an officer. Under it there could be no assistant engineers and no torpedo officer, and the other numbers as estimated here would be cut in proportion.

"14. Accepting the figures of the Bureau of Navigation (the above argument merely showing how low those figures are), the following list of vessels now under construction, which are to be completed by July 1, 1902, and which will require to be commissioned by that date, will show the number of officers required:

Vessels.	Officers.
Illinois	17
Wisconsin	17
Ohio	17
Arkansas	7
Nevada	7
Florida	7
Wyoming	7
Denver	12
Des Moines	12
Chattanooga	12
Cleveland	12
Galveston	12
Tacoma	12
16 Torpedo-boat destroyers	48
15 Torpedo-boats	30
7 Submarines	7
Total	236
25 per cent reserve	59
Grand total	295

"15. To the 236 officers required to actually officer the above-named vessels, a reserve of one-quarter has been added as being the number necessary to allow for those sick, otherwise employed, performing travel to and from ships, at navy yards, at the Naval Academy, and elsewhere throughout the navy.

"16. The following list, similar to the preceding, gives the number of officers required to fit out the vessels now repairing and out of commission. These would all be commissioned in case of war, and many of them would now be in service, were officers and men available, to increase the efficiency of the fleet in the Philippines, for duty in the Mediterranean, where there has been no squadron since 1898, and where ships are always needed in Turkish waters, etc., and to bring the North Atlantic and Pacific squadrons up to the strength which our home defensive squadrons should properly have:

Vessels.	Officers.
Indiana	17
New York	15
Texas	15
Columbia	14
Minneapolis	14
Baltimore	12
San Francisco	12
Olympia	12
Cincinnati	10
Raleigh	10
Detroit	10
Montgomery	10
Marblehead	10
Boston	10
Puritan	8
Miantonomoh	8
Katahdin	6
Alliance	6
Alert	6
Mohican	6
10 Torpedo-boats	20
Total	241
25 per cent reserve	60
Grand total	301

"17. In addition to the above and to look further ahead, we find the following list of vessels building or authorized, which will come up for commissioning subsequent to July 1, 1902, with the accompanying need for more officers:

Vessels.	Officers.
Maine	17
Missouri	17
Georgia	17
New Jersey	17
Pennsylvania	17
Virginia	17
Rhode Island	17
California	15
Nebraska	15
West Virginia	15
Maryland	15
Colorado	15
South Dakota	15
St. Louis	12
Milwaukee	12
Charleston	12
Total	245
25 per cent reserve	61
Grand total	306

"18. As a tabular summary of the above, we have officers needed in addition to present number:

For new vessels completing prior to July 1, 1902	295
For old vessels now in reserve	301
For new vessels completing subsequent to July 1, 1902	306
Total	902

"19. In other words, to officer in the lowest possible manner the navy which Congress has ordered built, there must be provided an increase of 902 in the number of officers now authorized, mainly in the grades of Lieutenant, Lieutenant of the junior grade and Ensign.

"20. Attention is invited to the fact that above estimates do not include officers to man auxiliary vessels which would be used in time of war, such as auxiliary cruisers Yale, Harvard, etc., colliers, supply vessels, refrigerating ships, distilling ships, repair ships, hospital ships, auxiliary gunboats, Gloucester, Scorpion, etc., and all the host of other similar important craft.

"21. The Bureau of Navigation recommends that, for the reasons herein set forth, the following provisions be inserted in the Naval Appropriation bill:

"'*Provided*, That, from and after the passage of this Act, there shall be allowed at the Naval Academy two Naval Cadets for every member or delegate of the House of Representatives, two for every United States Senator, one for the District of Columbia, and ten at large annually; *Provided further*, That the number of Lieutenants in the Navy of the United States shall be three hundred and fifty, and the total number of Lieutenants of the Junior Grade and Ensigns shall be six hundred; *Provided further*, That a Naval Cadet, upon successfully completing his four-year course at the Naval Academy, shall be commissioned an Ensign; *Provided further*, That no Cadet shall be prevented from being so commissioned by any law limiting the number of Lieutenants of the Junior Grade and Ensigns; *And provided furthermore*, that all Acts, or portions of Acts inconsistent with the provisions of this section, are hereby repealed.'

"22. In view of the foregoing statement of the need for officers the request for a present increase of 300 is certainly moderate.

"23. The recent liberal appropriations of Congress for rebuilding and expanding the Naval Academy are taking shape in commodious buildings which will ultimately be ample for the increased number of cadets, and in the meantime, by employing old sets of officers' quarters and otherwise, the immediate increase can be cared for.

"24. In this connection, though it has no bearing upon the actual number of officers available for duty, it is again urged that as a matter of right, justice and efficiency, cadets completing the four-year course be immediately commissioned as Ensigns. Such a measure would in no way remove any difficulty connected with the shortage of officers,

for the increased number of commissioned officers would be gained at the expense of so many cadets at sea.

"25. Any general or special provisions for readmittance to the Navy on any terms of persons formerly in the navy or for placing on the active list officers now on the retired list is most earnestly opposed. Most of the former class who are still capable of performing duty and wish to do so have received appointments in the Pay, Marine and Medical Corps. It is not thought, therefore, that line vacancies could be profitably filled from those sources. Such persons reentering the navy from civil life or being transferred from the retired to the active list are in an anomalous and undesirable situation. They cannot, with propriety, take rank among those with whom they formerly ranked, for they have lost all of the experience and service of the time spent in civil life or on the retired list. On the other hand, having advanced in years, they would not be willing to take rank in that part of the navy which has seen service corresponding with their own.

"26. Lest it should be said that the number of officers herein set forth as necessary for the proper handling of the Indiana, the following table is included, showing a comparison between the estimate of the Bureau of Navigation for the Indiana and the number of officers actually placed aboard ships of similar displacement by foreign powers:

Nation and ship.	No. of line officers.	Remarks.
England,		
Barfleur.....	33	Includes Midshipmen.
France,		
Bouvet.....	26	Includes Midshipmen.
Germany,		
Kaiser Frederich III.....	20	In addition to this there are a number of Midshipmen not here given.
United States,		
Indiana.....	17	Includes Naval Cadets.

"27. From this it is seen that even the estimate of 25 officers as given in the first part of this argument is the lowest complement of the four nations compared, for to the German number as given above, from 10 to 20 must be added for the Midshipmen. England, with the most efficient navy in the world, considers it necessary to have more than 30 officers aboard a battleship of the Indiana class. In the above table the number of officers given includes both line officers and engineers, to make the total correspond with our present line, which has both line and engineering duties.

"28. It will be noted that the above makes no provision for filling vacancies in the Marine Corps with Naval Academy graduates. This should be done, and will call for even more cadets than laid down herein.

"29. The following table shows the duty which officers of the line below the grade of Lieutenant-Commander were performing on January 1, 1901.

Grade.	Number in grade.	Number at sea.	Number on shore.	Number sick.	Per cent. at sea.
Lieutenant	300	180	117	3	60
Lieutenant (Jr. G.)	101	62	38	1	61
Ensign	111	106	2	3	96
Naval Cadet	111	108	3	0	98
Total.....	623	456	160	7	73"

In closing these comments, which have run on to a length never intended by me when I started, I desire to express my profound conviction that we have no room on board ship for any line officer who is a specialist in one branch to the *absolute exclusion of all others*. The doctor and the chaplain, I suppose, we cannot incorporate, and a construction corps that never goes to sea I suppose we must make up our minds to, but the line should include only men who can efficiently perform the daily duties of the old line, the old engineer corps, and of the old pay corps, as required, while each individual is competent to go beyond the daily duties of all in one or more special branches. There is no room in the navy of to-day for the officer who cannot do this.

Incidentally, I may say here that I believe that the sooner the marine corps and navy are merged in one, without prejudice to the individual members of either, the better it will be for the general service.

Therefore, I repeat in closing, *look out for the total and the subdivision will become an easy matter! Work, work, work*, to increase the number of cadets at the Naval Academy, not only to give us the total that we need, but to make sure that a constantly increasing number of vacancies in the line may not invite a flood of appointments of non-graduates, who are not only not specialists in anything, but who cannot perform even the daily duties, and who can never learn so to do. That is the duty that devolves upon every officer of the navy to-day, and I most earnestly beseech each and every one to rally to the preservation of the service from a danger that is only too real. Never mind the interior subdivision, but *attend to the total.*

Rear Admiral JOHN LOWE, U. S. N.—Could I be present to deliver in person that which I would like to say, it would be pleasant to prepare such discussion.

Confined, however, to a letter, I will only say this, that I am heartily in favor of the resuscitation of the engineer corps.

I think it was a mistake to abolish it, and its resuscitation will be for the good of our country and the service.

A healthy man needs a considerable time for recreation, and to be healthy he must not be allowed to do two men's work in one lifetime.

I favor also a Corps d'Elite, to wit, a corps of submarine-boat torpedoists, with a special uniform, for the reason that I believe the future of that mode of warfare will take a broad scope and receive much attention.

Civil Engineer A. C. CUNNINGHAM, U. S. N.—"The present Bureau of Yards and Docks, and the system that has heretofore prevailed of laying out and designing our navy yards and stations under many heads, would seem to be illogical, and has certainly led to much unnecessary expense and confusion. The placing of the whole navy yard system under the one head that controls the great bulk of the work done in them, would seem to be reasonable, and would undoubtedly lead to economy, efficiency and to the adoption of a systematic plan in the arrangement of shops and buildings.

"The present corps of civil engineers is an anomaly in a naval establishment filled with engineering skill, and its members should be joined as an adjunct to construction, which latter branch should have charge of the maintenance of yards, docks and stations, and no further appointments to the corps made. In the future the construction corps should contain its engineering experts to do the duties now performed by civil engineers, just as the line contains to-day its ordnance experts, and for very much the same reasons."

Thus the essayist disposes of the senior bureau and the junior corps in the naval establishment in a manner so at variance with the general tenor of the essay, and so illogically, as compared with some of the most important arguments, that some discussion of the matter is necessary.

When the bureaus of the Navy Department were established in 1842, yards and docks was made the senior bureau, and had the naval establishment developed on the lines proposed by the essayist, it could have been to-day the Division of Materiel, and on a reorganization might more easily and logically become such a division than any other bureau, from the fact that its interests do not in any manner conflict with others, which cannot be said of any other bureau dealing with *materiel*.

The mistakes that have been made in locating and laying out our yards and stations can not be charged to the Bureau of Yards and Docks as such. To some extent its various heads may have been responsible, but it will be more often found that yards and stations have been laid out, and buildings and works located by boards of officers containing few, and sometimes no engineering members At the present time the Bureau of Yards and Docks has no personal motive in the laying out of a yard or station or in the location of the various works contained therein, but can disinterestedly and impartially serve and guard the interest of all other bureaus. If this bureau were merged in the proposed bureau of construction, the impartiality and disinterestedness in yard design and arrangement would at once disappear, and the proposed leading Bureau of Construction would be arrayed against the proposed Bureaus of Engineering, Ordnance and Equipment, in securing and guarding its own interests.

Whatever reorganization might be attempted with the naval establishment, it would seem that the Bureau of Yards and Docks should naturally and logically be retained.

The essayist in the strongest possible manner deprecates the abolish-

ment of the corps of mechanical engineers, and then proposes to abolish another corps that represents an equally technical profession which existed before that of the mechanical engineer or the naval architect.

Laomi Baldwin, one of the leading civil engineers of his day, was employed by the Navy Department in the late twenties to design and build its first dry-dock, and from that day to this the naval establishment has found constantly increasing uses for civil engineers.

It is but a few years, comparatively, that the civil engineers have been formed into a corps of commissioned officers, and this step in development can but be followed by good results, as has been the case in the successive commissioning of surgeons, paymasters, the late mechanical engineers, and naval constructors. The giving of commissions to civil engineers will be as naturally followed by filling this corps with properly trained graduates of the Naval Academy as has been the case in the corps of constructors, and with equally good results. To abolish this corps and delegate its duties to the constructors, would be following exactly the lines that the essayist so greatly regrets in the abolishment of the mechanical engineer and the delegation of his work to the line officer.

The best reasons for the natural and logical existence of the corps of civil engineers will be found in the following quotations from the essay itself, for whatever can be said of mechanical engineering, or of naval architecture, as professions, can be as logically said of civil engineering:

"The duties of the navy are so varied that there is room for talent of all kinds.

". . . Its chief and assistants should be mechanical engineers of the highest order, and to be such can be nothing else.

"At a time when science in all its branches is advancing with such rapid strides, and when perfection and thoroughness in any profession require the full and entire effort of even a superior mind, and when specialism is the watchword to eminence and success in all professions, to practically abolish one of the most absolutely necessary and most highly specialistic branches of a modern naval service would seem to be contrary to all reason, and the teachings of experience.

"Neither the passing of a law, nor the giving of a title makes the line officer, the engineer or the constructor.

"It will already have been observed that the writer is no great believer in the universal genius of man, and is firmly convinced that the best work is generally accomplished by men who devote their whole time and intellect to one profession."

It will be noted in the quotation at the beginning of this discussion in which the essayist characterizes the civil engineer in the navy as an anomaly, that he also recognizes the necessity of his work and its performance by experts.

Motto:—"Jack of all trades is master of none."

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WARSHIP DESIGN FROM A TACTICAL STANDPOINT.

By Lieutenant John M. Ellicott, U. S. N.

Four principal elements enter into warship design, viz., battery, protection, radius of action, and speed. When it is attempted to combine these on a given displacement each crowds the other for space to such an extent that the limitation in displacement has steadily given way, until many students of the subject have concluded that this tendency must be stopped, even at a sacrifice. It is possible, however, that those so concluding are becoming disheartened when almost in sight of the goal, and that only by persistently designing warships which combine the highest tactical elements of their class, on whatever displacement these demand, can we hope to excel.

The order of importance of the elements in the design differs according to the class of vessel. Thus, for battleships, we should consider—

1st. *What combination of guns will produce the most efficient fighting battery?*

This is not a question to be settled by the ordnance expert alone, but by the tactician as well, for the battery carried must be considered, in its distribution, weight of metal delivered and arc of fire, as one of the aggregation of batteries which by tactical movements must be concentrated upon the enemy. To arrive at a solution of this question the consideration of the weight, range, energy and rapidity of fire of modern guns should be combined with a careful study of the best arrangement of guns on shipboard for concentration of fire in fleet actions.

The correct tactical arrangement of guns in a ship's battery is that which will deliver the greatest concentrated energy of fire

upon a vessel of the enemy, but where guns are mounted on shipboard, the necessarily elongated form of the ship makes such concentration possible only in a direction divergent from that of her length. The ship being mobile and dirigible, however, this concentration can be brought to bear toward any point of the compass with the aid of helm and screw. Hence, the strongest tactical arrangement of guns for a single ship's battery is that which gives the greatest possible energy of broadside fire.

A battleship is a unit of a squadron. She is, or should be, designed to fight in tactical combinations with other battleships; to add her greatest concentrated energy of fire to that of other battleships while executing with them similar movements. Being in squadron, she is no longer free to do this by means of helm and screw, for she is constrained to make only such turnings as will harmonize with those of other vessels engaged in the same tactical evolutions. Her battery itself must, then, be capable of the utmost arc of train in order to concentrate upon the same object as the batteries of other vessels. Thus the ideal tactical disposition would be one giving an all-round fire to every gun in a ship's battery and making it possible for every gun to bear in the same direction at once. There is but one way in which this is mechanically possible—to mount all the guns in turrets superposed one above the other in a single vertical column. This, of course, is practically impossible, but it shows that *as far as we can* superpose turrets we are following the dictates of tactics.

An evolution which brings to bear one ship's greatest energy of fire should not waste part of the energy of some other ship. In battleship design, the first effort should be to attain that assignment and arrangement of battery which will permit the greatest possible concentration of energy of fire in any one direction, *then to give similar batteries to every ship of the same class built.*

By superimposing 8-inch upon 13-inch turrets in our battleships Kearsarge and Kentucky, we have obtained a concentrated energy of broadside fire superior to that of any ship of their class in the world, and at the same time we have insured a better end-on-fire than seems possible with guns otherwise disposed in any battleships we have yet built. It is such a vast gain in tactical arrangement of battery that we should not recede from it because it is novel and has not had the test of battle; but should rather

strive to improve upon, or add to it. The structural and mechanical difficulties in installing the superimposed turrets seem to have been successfully overcome, but there is still one defect in them, more apparent than real. That is the rigid connection between the 8-inch and 13-inch turret. It is this seeming defect which opponents of the system strive to bring out by supposing the Kearsarge attacked by a vessel on each quarter, one of these assailants needing the attention of her 8-inch guns. These guns would, it is claimed, take the 13-inch guns with them and leave the Kearsarge's other side to sustain an unequal combat. Such a divided attack, however, even upon the Kearsarge, would be a cardinal tactical error, permitting her to use *all her guns;* whereas a combined attack of her two assailants from one general direction would permit the heaviest concentration of both their batteries upon a portion only of the total battery of the Kearsarge. For illustration, let us suppose this ship attacked by a Kentucky and an armored cruiser. The two battleships would be matching gun for gun, and the cruiser, if concentrating on the same side as the Kentucky, would be delivering her whole broadside unopposed, whereas on the other side she would be receiving the fire of seven additional 5-inch guns. Now replace the Kentucky with another armored cruiser and we have the Kearsarge attacked by two armored cruisers of, say, fifty per cent of her battery power each. If they concentrate on one side of her they will fight her on about equal terms. If they attack on different sides the Kearsarge will be able to concentrate her whole energy of fire upon one of them while using against the other seven 5-inch guns, otherwise idle. It seems hardly necessary to carry the illustrations farther in order to prove that the divided attack proposed is tactically unsound, and should be encouraged by the Kearsarge (if caught in such an emergency) rather than avoided. Nevertheless it can always be rejected by a shift of the helm.

I believe it to be mechanically possible to so arrange the superimposed turrets in new models as to make them turn separately, and thus restore independent mobility, if it is really desirable, to the 8-inch guns.

2d. *What protection must be given to the battery to make it as invulnerable as possible?*

This again is a question for the tactician as well as the ordnance expert, and although fights between armored vessels have not

been numerous, they point very decidedly to the value of protection and the necessity for more of it, *especially protection of the personnel.*

A vast weight of armor is now devoted to a water-line belt, yet in all the history of naval warfare since guns have been used, it is the rarest thing to find recorded a ship sunk by gun-fire. In the days of sails, battleships were placed *hors de combat* by the destruction of their motive and directive power, *i. e.*, their sails, masts and rudders; or by the destruction of their personnel. Now, the motive and directive power can be invulnerably disposed below an armored deck. Should we not devote the further disposition of armor chiefly to the protection of the personnel, instead of so largely to insuring flotation, which history shows us has so seldom been destroyed by gun-fire under any circumstances?

3d. *How far must this battery be carried to attack our most distant possible adversary?*

This is a matter of geographic measurement, and coal-consumption per mile at economic speed, adding sufficient fuel capacity to sustain the ship while establishing a base on the hostile coast.

4th. *At what speed must this battery be carried to insure its coping with any of its class afloat?*

This is a question of boiler, engine and structural design with a view always to equal foreign models, and to excel them when it can be done *on the same weight and space*, for while an excess of speed in battle is unquestionably advantageous, it certainly would not be so at the sacrifice of any other offensive element in a battleship. Speed is of more value in strategy than in tactics.

The four considerations enumerated become, when settled, elements of volume and weight, and it remains to determine—

5th. *What structure must be built to carry them?*

The aggregate of these five items gives the size of the tactical unit of battle afloat—the battleship. The number of these units must be determined from the strategic features of our coasts and the naval force of our strongest possible adversary, and legislators must be kept fully informed as to this need.

This method does not suggest indefinite increase in size, for each item has its limit; in fact, seems to have already reached its limit in the directions of volume and weight. In these respects guns reached and passed the limit some years ago and have

dropped back to lighter weights and calibers. Their improvement now is entirely in the direction of greater strength of material, better explosive propelling agents and a more economic use of them.

Armor seems to have reached its limit in thickness, and invention now turns to increasing its hardness and toughness.

The distance to which we must carry the battery has geographic limitations, while improvement in fuels and methods of coaling at sea may reduce fuel weights carried.

Speed, if increased much in large ships, seems likely to be accomplished by new designs in engines and boilers involving economic use and spacing of motive power rather than increase in volume and weight of generating and transmitting parts.

The consensus of building opinion of the present day, as illustrated by the latest battleship designs, indicates that all the best elements can be obtained on a displacement of 15,000 tons, and we may expect, in the future, to see equally good fighting units, and even better, produced on smaller displacements. Let those who shrink from war vessels of great displacement remember that they insure a special tactical advantage over smaller ones in their greater steadiness of gun platform.

Armored Cruisers.

Land campaigns in the latest wars with up-to-date weapons have demonstrated that it is absolutely essential to success to have a large component of the fighting force specially equipped for mobility, swiftness and great radius of action; in other words, to have a mounted infantry. The campaign in the Philippines made no permanent progress until, with such a force, we could outstrip the ever-fleeing foe and bring him to bay. The campaign in South Africa was a deadlock until the British had a sufficient mounted infantry force to turn the enemy's positions by long and unperceived detours, sever his communications and fall upon exposed points.

Warfare afloat has ever been analogous in its principles to warfare on land. If a fleet at sea should persist in avoiding battle by Fabian Tactics, the opposing fleet, if it possessed only equal characteristics, might fail to bring on a decisive engagement until crippled for want of fuel, whereas, if it were made up in

part of a class of vessels having superior speed and radius, yet retaining sufficient protection and armament to endure the shock of combat, this portion might overtake, cut off or hold the elusive enemy until the main body came up. Again, two fleets of battleships having equal tactical characteristics, might fight to a standstill without decisive advantage, and one or the other might withdraw to shelter, whereas, if one fleet possessed a division of vessels superior in speed, mobility and radius, the other fleet could be shut out of its place of refuge and possibly forced to surrender. The survival of the Chinese battleships in the battle of the Yalu after four hours' hammering, indicates that fighting to a standstill is not an improbable outcome in future naval combats where reliance is placed exclusively upon battleships.

Another feature of great importance in naval as well as land warfare is reconnaissance, and reconnaissance is not satisfactory unless pushed home until the main body and strength of the enemy is disclosed. Vessels suited to this purpose must have coal-endurance for a long search, battery enough to beat-in the enemy's outposts, high speed to dash into close touch with the main body and then to get away, and sufficient protection to stand punishment while under heavy fire.

We should, then, have a mounted infantry of the sea as well as a mounted infantry on land, and the type which will fill this requirement seems to be the armored cruiser.

Armored cruisers, therefore, ought to fulfill the following conditions:

They should be able to overtake battleships in chase within the limits of daylight. This would necessitate a superior speed of at least two knots.

They should be able to keep the sea at cruising speed at least half as long again as battleships, and, if possible, a good deal more than half.

They should have the same protection as a battleship, as nearly as other conditions will allow.

Their reduced battery should be homogeneous in calibers and tactical disposition to that of battleships.

Briefly stated, there must be a sacrifice of battery and protection to speed and endurance, and this sacrifice should be chiefly in battery. As a bare statement, this will be challenged, but it can be shown from our own recent battleship designs that on

about 12,000 tons we can, by sacrificing battery alone to speed and endurance, produce an armored cruiser equal to any under construction.

Take, for example, the Kearsarge. She has a displacement of 12,300 tons with her total capacity of 1200 tons of coal. By taking away her 13-inch guns, mounts, turrets and ammunition, and reducing her 13-inch barbettes to suit the 8-inch turrets we would remove about 1400 tons. On this we can get 2000 tons coal-capacity, add 50 per cent of weight for her motive power and have 100 tons left for such increased weight of hull as would be necessary in fining her lines and increasing space for fuel, and thus produce a ship having a radius of 10,000 miles and a speed of 20 knots, which could take her place, when necessary, in the line-of-battle beside the Kearsarge with the same immunity, and with a similar battery up to and including her 8-inch guns. If we compare such a ship, element for element, with the latest armored cruisers built or building abroad, even with those of greater displacement, we will find that, although sometimes slightly inferior to them in speed or radius, she would in every instance outclass them when brought to battle.

Such is an armored cruiser, and by comparison it appears that her limit of displacement could for the present be fixed at 12,000 tons, with the expectation, as in the case of battleships, that equally good ships of the type can in the future be produced on smaller displacements.

Protected Cruisers.

The functions of armored cruisers with the fleet in time of war are too important for them to be sent to fritter away their endurance by threshing about the theater of war for those bits of superficial information and first touches with the enemy's forces, which serve, by aggregation, to shape the attack or defense, yet there must be vessels to do this, and, from the nature of the work, there should be many of them. They must be ships of greater speed and endurance than warships of any other class, and their endurance should be exceedingly great, not alone in fuel, but in seaworthiness, habitability, distilling capacity, provisions, cold-storage and self-repair. They must have battery enough to whip all improvised and auxiliary war

vessels, and to fight, with at least even chances, any vessel of their own class—but it is not their duty to fight vessels of a superior class. They should be protected from such by their greater speed and by an armored deck over their motive and directive power, which would insure their escape from gun-fire before being crippled. Their ammunition hoists should be heavily protected, but gun positions need only protection from rapid-fire projectiles; the limit of thickness of such protection being that above which some sacrifice of special type characteristics of these vessels would enter in.

Such a vessel is a protected cruiser. When with the fleet, or operating for the fleet in time of war, she is a scout.

More war vessels have been built approximating to this type than to any other, yet they have seldom been designed to take their legitimate place in the war fleet. Some are merely economic structures built to "show the flag" in foreign ports in time of peace. These are always deficient in speed and some branch of endurance. Others are designed solely as "commerce-destroyers" and have insufficient battery and protection. Commerce-destroying, however, except with an otherwise impotent naval power, should only be incidental to the operations of naval warfare, and is not worth a special design. Protected cruisers designed for their legitimate war purposes as swift, enduring, well-armed seekers of information, or scouts, will also fulfill the highest requirements of commerce-destroyers, or of cruisers for the peace establishment. They are also of the type needed for commercial blockade and search and for protecting landing parties.

A protected cruiser, therefore, should fulfill the following conditions:

1. She should be the fastest ocean-going war vessel afloat.

2. At economic speed, her fuel endurance should exceed that of all other types of war vessels.

3. She should excel all other types in her provision capacity, distilling and freezing apparatus, and workshop appliances, and she should be sheathed.

4. She should have a complete protective deck, heavy enough to keep out the largest projectiles. Her cellular subdivision of hull should be the most complete now designed. Her bat-

tery should be protected from secondary-battery fire as much as other requirements permit, while her ammunition hoists, conning-tower and helm connections should be heavily armored.

5. By comparing protected cruisers of different countries it will be found that, to equal the best armed ships of the type, the battery should be at least four 8-inch guns, ten 6-inch R.F. guns, and secondary guns in proportion.

After carefully scrutinizing the characteristics of all protected cruisers built and building the world over, there seems to be no better type on which to base modifications than our own cruiser Olympia. With all coal aboard she is a 6000-ton vessel. By increasing her displacement 2000 tons she could be made a 23-knot ship, with 16,000 miles radius of action, carrying a battery superior to that of any vessel of her class, and with protection adequate to the type. This would make the maximum displacement for a protected cruiser 8000 tons.

Gunboats.

Now that we have turbulent insular possessions full of intricate waterways, as well as growing interests in unstable countries accessible chiefly through long and shallow rivers, it is important that we should consider more carefully the characteristics needed in gunboats. A study of our gunboat-work in the Philippines will teach us that there is a special sphere of work for such vessels; in sweeping the shoreline ahead of advancing troops, protecting their shore flank or enfilading that of the enemy; in making reconnaissance of narrow and intricate channels and cutting out small craft, and in ascending rivers to keep open communications and convoy supplies to interior points.

They will thus be constantly exposed to small-arm and machine-gun fire, and a special feature of their construction should be adequate protection against such fire. Above-water plates should be thick enough to keep out small-arm bullets, and bulwarks should be constructed to serve like breastworks. Such protection should extend to the positions of those navigating the vessel, including the lookouts aloft. This could and should be done to gunboats and picket boats already built. If it were, we would escape such mortifying disasters as that to the Urdaneta at Orani.

Gunboats must, as we know, be of light draft, which can be determined by a study of the hydrography of their probable stations. They should carry the best rapid-fire and machine-gun battery commensurate with their size, and have as much coal and provision endurance as possible. Speed is of minor importance, and sheathing would be superfluous, for they can be hauled out almost anywhere at small expense and cleaned.

Coast Defense Vessels.

Coast defense means harbor defense. If batteries are to be mounted for the defense of a harbor, they should be mounted on shore and not afloat, for they can not only be made more invulnerable and carry greater armament, but their ever-steady platforms and the greater possibility of range finding render their fire immeasurably more accurate. There is a tendency in this country to build monitors for harbor defense, and I once thought they had their place in the composition of the fleet; but further tactical reflection, and their recent behavior off the coast of Cuba, have reversed my opinion. They are tactically useless except in smooth water. A monitor is but the first crude material shape of a tactical idea, *i. e.* of an invulnerable revolving battery upon an unsinkable hull. The battleship of to-day, especially with superposed turrets, is the evolution, the perfection of the monitor, retaining the tactical advantages of the latter in the turrets and protective deck, and remedying by a vaster structure the tactical shortcomings of unstable platform, low freeboard, limited speed and endurance and small battery. The real coast defense vessels are battleships on the high seas ready to fall upon the enemy in whatever port he strikes. There may be some harbors whose configuration calls for defenses at points where there is no land, but they are few in number, and can be definitely picked out by local tactical examination. In these, monitors would be useful; perhaps necessary, but I suspect that we already have plenty for that purpose. To my mind the only special type of vessel needed for harbor defense is the torpedo-boat, and torpedo-boats will never figure largely in any war of ours except as harbor defense vessels. For this purpose we should continue building them until we have a flotilla for every important harbor in the country, and should thereafter maintain them in number and efficiency.

Naval Auxiliaries.

If all naval auxiliaries were to be specially designed and built by the government it might, perhaps, be ideal, but their care and maintenance in peace times would be an expense out of all proportion to the tactical advantages to be gained from such designs in time of war. Nevertheless, there are two types of auxiliaries which both tactics and strategy demand shall be ever near or with the fleet in time of war, and which could always add to its mobility and efficiency in time of peace, viz., the collier and repair ship.

Von Moltke, having land campaigns chiefly in mind, said that strategy was three-fourths geography. Had he been an admiral, I think he might have added "and one-fourth coal." Other things being equal, that combatant which best solves the problem of coaling its fleet in time of war, will come out victor. All sea powers realize this, as is evinced by their efforts to seize islands and establish coaling stations here, there and everywhere in the waters of the oceans; yet every student of strategy knows that such coal piles will be used by whichever contestant proves to be the stronger highwayman in their vicinity for the time being. Briefly, the disadvantages of a coaling station are:

Its location is exactly known to the enemy.

If it lies on your line of communication toward him it is equally on his toward you, and will be as accessible to him as to yourself.

It is immobile and must be sought at greater or less distance from the theater of operations.

On the other hand, for colliers, we have the reverse conditions: They are mobile and can be sent to any desired rendezvous, and away from it again, if necessary, after coaling from them, or they may be kept constantly with the fleet.

They need never serve to replenish the enemy's bunkers, for they can be sunk when in danger of capture.

Even with coaling stations, colliers are ultimately necessary for replenishment, and in the long run the possession of coaling stations is but an added risk of serving the enemy.

Of course the great advantage of coaling stations, in fact their only *raison d'être* as a strategic precaution, is that they

afford harbor facilities for coaling, but the problem of coaling from colliers at sea seems fairly solved, and if coal is kept afloat with the fleet in time of war, it will not be difficult to find sufficient shelter to permit its transfer to the bunkers when necessary.

If, however, colliers are to accompany the fleet, they must not be in any sense impediments. They should be specially designed and navy-built, with the following characteristics:

A cruising sea speed at load draught equal to that of battleships.

Devices for trimming with sea water to maintain their immersion as their cargo is diminished, or to keep them sufficiently immersed to maintain their speed.

All the recent appliances for coaling vessels at sea.

Arrangements to quickly sink the vessel when necessary to avoid capture.

Ample equipment for quickly abandoning ship in such an emergency.

A well arranged battery of light rapid-fire guns, with protection to navigating positions and to battery sufficient to keep out projectiles of its own calibers.

A protective deck over boiler and machinery spaces.

The necessity for repair ships of the Vulcan class was demonstrated fully in the Spanish-American war. They should be navy-built and maintained in peace times as well as during war. One at least, should be on every station we maintain, and they should accompany their squadrons in cruises and maneuvers. They would not only add to the tactical efficiency of the fleet at all times, but would, by curtailing expensive sojourns at navy yards, prove an actual monetary saving to the government.

The Number of Ships.

While it is of vital importance to determine by careful study the best types, characteristics and sizes for warships, it is of equal importance to develop a definite, continuous and progressive building program. To this end, we should study the methods of the country or countries most closely comparable to ours in commercial and colonial conditions and in national rank. Take Germany, for instance—a young nation with an

agricultural, manufacturing and commercial population; with a littoral and interior water communication similar to ours; with a growing, world-wide trade, and with newly acquired colonial possessions. She is closest to us to-day in naval power, and we will run a close second to her in naval construction for the next four years. She has, moreover, a carefully matured program already established by far-reaching legislation, which is to bring her navy up to a certain strength in a certain number of years and to maintain it at that strength thereafter.

We cannot, with certainty, maintain our position as a world power unless we adopt some such program. It is a problem which can be solved by answering the following questions and acting upon the answers:

1. How many battleships should we have to-day in order to cope on equal terms with any other first-class naval power?

2. That number provided for by a program covering the briefest practicable length of time, how many additional battleships must we build each year to maintain a total force in undiminished proportion to that of our strongest naval competitor?

3. What should be the retiring age of a battleship, and, that determined, what yearly construction will be necessary to fill vacancies caused by retirement?

The above three questions answered will give us a definite number of battleships to be built each year for a period reaching continuously into the future as far as construction in other countries will give us data for computation. Next, to insure tactical homogeneity in the fleet we should determine that—

For every N battleships there should be X armored cruisers, Y protected cruisers, Z navy-built colliers and Z^1 navy-built repair ships.

We are separated by oceans from all other great naval powers. It seems reasonable to presume that none of them could afford to send more than half their battle fleet away from home waters in a war with us. Great Britain is the greatest naval power and has fifty battleships. We should, then, have twenty-five built or nearing completion. We actually have fifteen and should provide ten more in the shortest time practicable to make up our deficiency. At the same time we must watch the yearly budgets of all other naval powers and build additional battleships in proportion to our closest competitor.

The only country which has, as yet, placed a legislative retiring age upon warships, is Germany. She retires battleships after twenty-five years' service. Without exact data we would do well to adopt that figure in order to maintain a definite building program.

Being thus able to designate exactly the number of battleships which should be laid down each year for as many years ahead as we please, the number of vessels of other classes to be built should be worked out proportionately from tactical considerations. If the correct tactical use of armored cruisers is that which I have suggested in the early part of this paper, *i. e.*, as a mounted infantry of the sea, they should constitute about one-third the line of battle. It may be stated then, that for every *two* battleships there should be *one* armored cruiser.

Scouts cannot be too numerous. It is conservative to say that to every ship-of-the-line should be built one scout. For the three ships above enumerated there would thus be three protected cruisers. Basing them upon the battleships it may be stated that for every *two* battleships there should be *three* protected cruisers.

Gunboats, being designed for special purposes and localities, are not, tactically, a part of the battle fleet, but tactics demands a due proportion of colliers and repair vessels in a theater of operations. The six vessels which would be provided in the preceding apportionment would carry 9000 tons of coal. They would need two 5000-ton colliers ever present with them to refill their bunkers. They should also be accompanied by one repair ship. The algebraic expressions in the tactical rule for new construction can, then, be replaced by figures, thus:

For every 2 battleships there should be 1 armored cruiser, 3 protected cruisers, 2 navy-built colliers and 1 navy-built repair ship.

The building of ships is not alone sufficient to maintain an adequate navy. It is imperative that the personnel shall expand with the material. In 1882, it was decided by the Navy Department that 1500 officers and 7500 men constituted a sufficient permanent personnel for sixty vessels of the kind we then had. Since then, the navy has increased 75 per cent in number of ships, many of them vastly larger and more complex than those of 1882, and the enlisted force has been almost proportionately increased, while the commissioned personnel has re-

mained practically unchanged in aggregate numbers. This attenuated condition of the officers' list is not only alarming, it will soon become irreparable, for it takes longer to make an officer than to build a battleship. On our own officially stated basis of 1882 we should now have at least double the number of officers, in all grades, that we actually have, and it should be a matter of fixed law that the personnel, both officers and enlisted men, should ever hereafter be proportionate, year by year, to the ships fit for service.

The Spanish-American War has given the people of the United States two great object lessons in the usefulness of a navy. The legislative branches of the government, in accord with the newly awakened appreciation of the people, seem ready to respond to the naval needs of the nation. Now, therefore, is the time when we, whom the nation has trained to fight its battles on the sea, should tell Congress in no uncertain way the equipment we need to do that fighting. Only the artisan knows what tools he needs in his art.

The hand-to-mouth policy will no longer do. We have become a world power, "whether we would or no," and we have got to arm for international strife, or we will be despoiled, maltreated and thrust into oblivion by our neighbors. If we can formulate a plan for naval armament which is adequate, progressive and definite, Congress will, I believe, legislate upon it from year to year with much less debate and curtailment than that which now follows our desultory demands.

That nation which is best prepared to maintain its position in the great community of world powers *vi et armis* is most likely to have peace.

Appendix.

Weights removed from Kearsarge by taking out her 13-inch battery, as shown by "Report of the Secretary of the Navy, 1896," pp. 280 and 281:

Approximate weight of 13-inch:	TONS.
Barbettes, bolts, nuts, and wood backing	610
Turrets and attachments, and wood backing	530
Guns and mounts	375
Ammunition	160
Turret-turning machinery	100
Total	1,775

Replaced by :		
Structural parts common to 8-inch and 13-inch turrets	160	
Barbettes for 8-inch turrets	200	
Turning machinery for same	15	375
Net reduction in weight		1,400
Replaced by :		
Additional coal	800	
Increased motive power	500	
Changes in hull	100	1,400
		0,000

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A METHOD FOR DETERMINING THE TACTICAL DIAMETERS AND OTHER MANEUVERING POWERS OF SHIPS.

Description arranged by Lieutenant L. H. CHANDLER, U. S. N.

The writer lays no claim to having originated this method, it having been suggested in the summer of 1900 by Lieutenant-Commander W. I. Chambers, U. S. N., and used at that time aboard both the Texas and Massachusetts. Whether or not it is original with that officer is not known, but the writer has never been able to discover it in print and deems it worthy of being put into such shape as to be readily accessible to the service at large. Hence the preparation of this article.

In the description that follows, the case of the U. S. S. Massachusetts has been taken, the observations being made some miles to the eastward of Boone Island Light, off the coast of Maine.

In this method three observers are necessary as follows:

A. One at the bridge compass, who has pasted on the glass of the compass a dumb card showing only every second point as North, NNE., NE., etc. This dumb card should be so placed that its north point is at the forward lubber's point, and, as a result, observations taken from it will merely show the angle of the object from the bow, and will have no magnetic value. The compass is thus practically converted into a pelorus with its zero set to head and graduated only to every 22½°. (This might be advantageously modified perhaps, by making this dumb compass show every twenty degrees, which would knock out fractions and simplify plotting.)

B. One at the pelorus, which is set with its zero to head and kept that way throughout the observations. Angles observed

with it have therefore no magnetic values, but are merely angular distances from head to object.

C. One in a boat, who measures the distance of his boat from the ship by stadimeter at every blast of the ship's whistle.

There are three objects necessary upon which to take observations, and, lettering them to correspond with the letters above given to the observers who take them, they are:

A. A distant, stationary object, at such a distance that its bearing from the ship will practically remain the same as its bearing from the boat throughout the maneuvers. It will be noted later that this point of distance of object is very important, as the accuracy of the results depends upon it.

B. A boat, which shall be so fitted with a drag as to have the same drift as the ship. It is suggested that a heavy weight at the bow and another at the stern of the boat, lowered to a depth equal to the draft of the ship, with a sheet of canvas stretched between the two supporting lines will make an excellent form of drag for this purpose. Assuming that the boat, which of course must not be anchored, has thus been given the same drift as the ship, it is evident that the said drift may be neglected, and the question will therefore be considered as if no drift were present. In order that the drift of boat and ship shall be approximately the same, it is important that there shall be little wind or sea, or otherwise the drag will not have the desired effect, and the boat will go to leeward faster than the ship.

C. The ship herself.

Having everything ready as indicated above, the boat is lowered and left behind. It will be found convenient to steam some distance away from both boat and distant object, and then turn and head for them both on range or nearly so. This is not absolutely necessary, however. Then the swing should be begun as near the boat as practicable in order not to get any further away from her than necessary. Of course the possibility of taking observations accurately between boat and ship will limit the ship's approach to the boat, but having due regard to this, the nearer the two are together throughout the swing and the farther the distant object is from the two, the less will be the error introduced by the assumption that the bearing of the distant object from the ship remains the same as that from the boat throughout.

When in the proper position relative to the boat, with both boat and object bearing North by dumb compass and pelorus, blow the whistle and put the helm over, say to starboard, recording bearings and stadimeter distance of ship from boat.

Observer *A* then promptly sets his azimuth circle on NNE. by dumb compass, and when the distant object crosses the line of the vanes he gives the word "mark" and blows the whistle. At "mark" observer *B* notes the bearing of the boat by pelorus in degrees, and observer *C* records the distance of the ship from his boat in yards by stadimeter.

This process is repeated every time the bearing of the distant object changes two points by dumb compass.

In swinging it must be borne in mind that the least distance to which the service stadimeter is marked is 200 yards. Also that, as long as the distance does not get below that limit, the less the distance is between the boat and the ship the less the error in the stadimeter reading is likely to be.

The speed may be in a measure followed throughout the swing by having the engine-room counters read at every whistle blow.

The results should be finally tabulated as shown in Plate I.

Having obtained the data tabulated in Plate I, take an old chart, having on it a compass rose marked in degrees, and assume the boat to be at the center of the rose. Another useful device that can be used for this purpose is compass Form II, the dygogram sheet, which has been used for plotting on Plate II, the center of the graduated circle being taken as the position of the boat.

Lay off from this center the angles shown in the eighth column of Plate I, measuring on each line thus drawn the corresponding stadimeter distance, and the curve is easily plotted. The assumption is that the line from the boat to the distant object is parallel to that from the standard compass to the same object, and therefore that the angle between the distant object and the boat as seen from the compass will be equal to one hundred and eighty degrees minus the angle between the compass and the distant object as seen from the boat.

It will be noted that observers *A* and *B* will naturally be so near together that one recorder can care for them both.

Also, if the assumption be made that these observers are directly over the turning point of the ship, which will generally

be nearly correct for observations taken from the bridge, the observations taken by *B* will enable the keel line of the ship to be plotted for each position.

(On Plate II it will be noted that certain inaccuracies exist as regards drift angle. For instance at Position 12, the keel line of the ship should be at right angles to the line through the lighthouse and the boat, but it is not so on the plate. The keel lines shown on this plate were plotted as described in this paragraph, and there is no apparent reason for this inaccuracy. The results being those obtained from the Massachusetts, there may have been some error in observing or recording which has given this discrepancy. Its existence does not affect the general description herein set forth, so no effort has been made to reconcile it.)

The great advantage of this method is that all magnetic bearings are eliminated, and hence errors due to drag of compass, etc., do not enter. Also, the effect of current is fairly well eliminated.

The disadvantage of the method is that the distant object observed must be at a very considerable distance. It is thought that in general this condition can be obtained, however. If this distance be too short, the resultant error can be reduced by so conducting the swing that the line passing through the distant object and the boat shall also pass through the center of the circle instead of being tangent to it. It will be found that if the line of bearing of boat and object be tangent to the turning circle, a maximum error of one degree will result when the object is 32.5 miles away, with a ship whose tactical diameter is 1000 yards, and when the object is 16.3 miles away with a ship whose tactical diameter is 500 yards. Of course if the line of bearing of boat and object be made to pass through the center of the circle, or approximately so, tactical diameters of twice the above length may be determined from objects at the stated distances without exceeding the maximum error of one degree.

Other tactical qualities of the ship, such as the S turn can be determined in a similar manner.

PLATE I.—TACTICAL DIAMETER.

Ship—U. S. S. Massachusetts.
Date—September 10, 1900.
Place—Off Boone Island, Maine.
Speed at beginning of swing— ..... Knots.

Wind— Direction, N.W. Force, 1-2.

Sea— Character, Smooth. Direction, ...

Distant Object Observed—Boone Island Light.
Distance of Object—15 miles.
Helm—Starboard, 30°.
Engines— Starboard, Ahead. Port, Ahead.

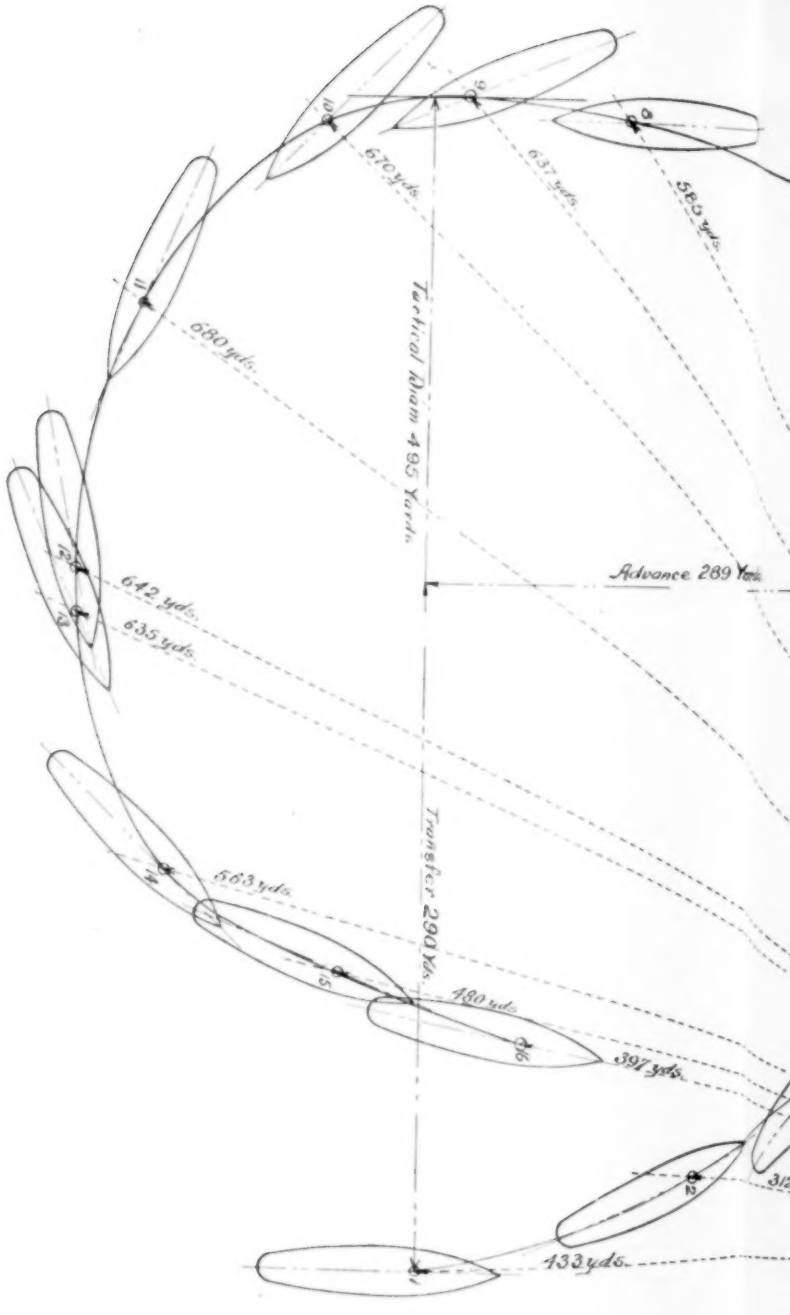
	Record of Ship.			Record of Boat. Observer "C."			Difference of Bearing of Boat and Lighthouse.	Remarks.
	Time.	Observer "A." Bearing of Lighthouse.	Observer "B." Bearing of Boat.	Recorded Time.	Corrected Time.	Distance. Yards.	Degrees.	
1	3-55-30	N.	N. 2° W.	4-05-30	3-55-30	433	2 W.	
2	3-56-12	N.N E.	N. 27° E.	4-06-12	3-56-12	312	4½ E.	
3	3-56-32	N.E.	N. 64° E.	4-06-32	3-56-32	235	19 E.	
4	3-56-52	E.N.E.	S. 70° E.	4-06-52	3-56-52	225	42½ E.	
5	3-57-08	E.	S. 31° E.	4-07-08	3-57-08	279	59 E.	
6	3-57-27	E.S.E.	.....	4-07-27	3-57-27	355	.....	View from Pelorus obstructed.
7	3-57-46	S.E.	S. 21° W.	4-07-46	3-57-46	427	66 E.	
8	3-58-30	S.	S. 54° W.	4-08-30	3-58-30	585	54 E.	
9	3-58-52	S.S.W.	S. 73° W.	4-08-52	3-58-52	637	49½ E.	
10	3-59-18	S.W.	W.	4-09-18	3-59-18	670	45 E.	
11	3-59-40	W.S.W.	N. 77° W.	4-09-40	3-59-40	680	35½ E.	
12	4-00-08	W.	N. 64° W.	4-10-08	4-00-08	642	26 E.	
13	4-00-32	W.N.W.	N. 43° W.	4-10-32	4-00-32	635	24½ E.	
14	4-00-56	N.W.	N. 29° W.	4-10-56	4-00-56	563	16 E.	
15	4-01-24	N.N.W.	N. 9° W.	4-11-24	4-01-24	480	13½ E.	
16	4-01-47	N	N. 12° E.	4-11-47	4-01-47	397	12 E.	

Standard time is that of Ship Observer.
Error of time of Observer "C," 10 min. fast.

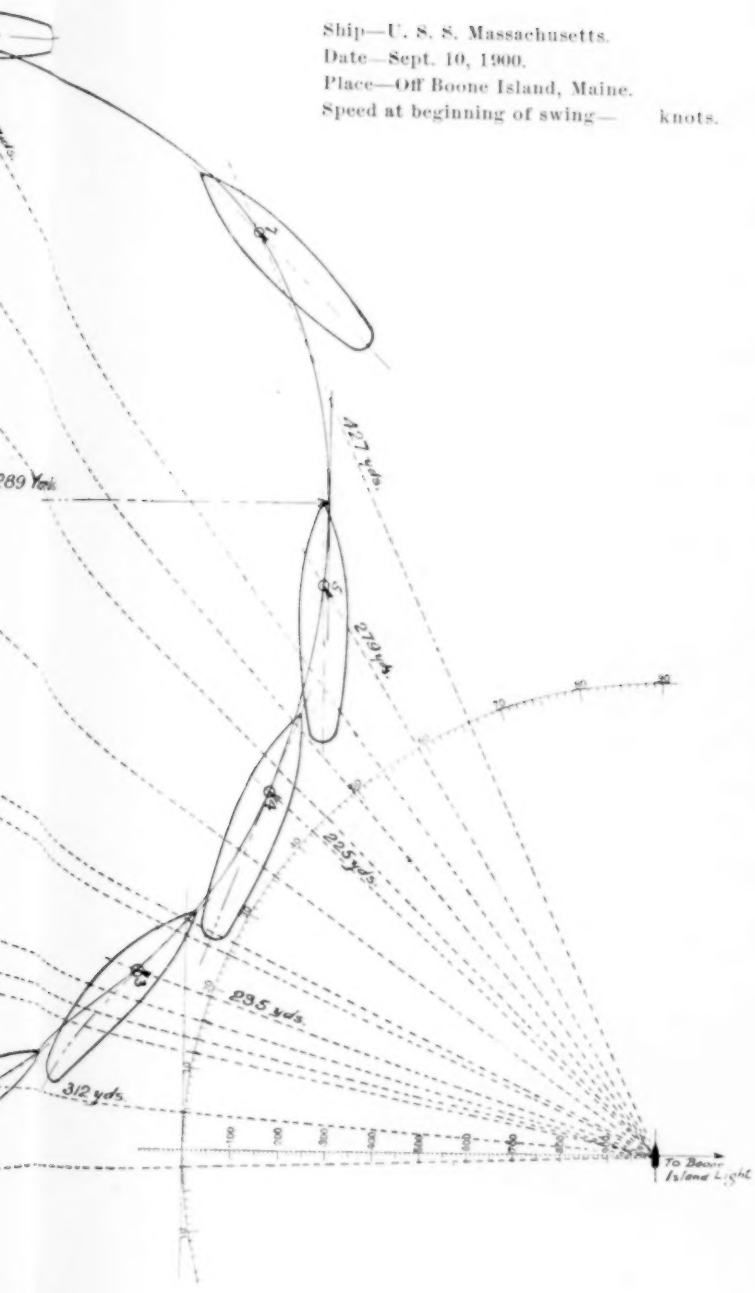
Results— Tactical Diameter, 495 yards. Advance, 289 yards. Transfer, 290 yards. Time, 6 min. 17 sec.

NOTE.—View was obstructed for bearing of object S.S.E. No observation on that bearing.

PLATE II.—TACTICAL



Ship—U. S. S. Massachusetts.
Date—Sept. 10, 1900.
Place—Off Boone Island, Maine.
Speed at beginning of swing— knots.



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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

NOTES ON FIRING INTERVAL, WITH EXAMPLES.*

By LIEUTENANT CHARLES B. MCVAY, U. S. Navy.

(1) Were a gun mounted on shore and fired at a stationary target, a telescope sight being used, then:

If the gun returned to battery in its original position (which assumes that there is no movement of the mount), the gun-pointer would see the target in its original position in the telescope field. If he watched the splash of the shot in the field and placed the target at that point for the succeeding shot, he would score a hit.

Suppose the target to have been placed at the junction of the right vertical and horizontal wires and the splash noted at x (Sketch 1). This would show that the shot was high and to the right. If he now put the target at x, it would be necessary to lower the muzzle of the gun and train it to the left, correcting his errors.

This is impracticable for a gun-pointer on shore, as the gun will not return to its original position; and is absolutely impossible at sea because the ship moves a considerable distance (1.7 feet for each second of flight at speed of 1 knot) between the times of firing and shot striking, as well as the fact that the ship rolls or yaws through a considerable angle, as will be shown later.

It might be possible, however, for an observer, with a telescope similar to the one mounted on the gun, to stand behind the gun and, keeping the target in the proper position, to note the splash. For instance, if both telescopes were notched for every 5 knots

* For part of data I am indebted to Professor Philip A. Alger, U. S. Navy and Lieutenant L. C. Bertolette, U. S. Navy.

speed on horizontal wires, and had similarly spaced notches on vertical wires as in Sketch 2,* and the gun was FIRED when the target was on the right and horizontal wires, then, if the observer noted the splash at *x*, he could say "3 right, 2 up." The gun-pointer would keep his sight at the original elevation and could, by placing the target at *x* in his field, make a hit without knowing the range.

(2) Paragraph 1 would hold good only when the gun was FIRED when the target was as stated. If the gun-pointer pulled the lanyard or pushed the button at that time, he must know his *firing interval*, which is assumed to be the time elapsed between thinking of pushing the button and shot leaving the gun.

Time after time it has been seen that a gun-pointer, in sub-caliber practice, will hit, miss, hit, miss—the misses being due entirely to the fact that his "firing interval" had been neglected. Perhaps the turret was being trained or was swinging to the right and he made a hit by pushing the button when the target was on the right vertical and horizontal cross-wires. He saw the target moving along the horizontal wire and pushed the button when the target was on the right vertical wire. If the turret be now trained or swung to the left he cannot push the button when the target is on the same vertical wire, because, in the first shot, the gun may have been FIRED, not when the target was on the right vertical wire, but when it was at *a* (Sketch 3), so that he has corrected for but 4 yards at 1000, though thinking that his correction was for 8 yards. If the turret is now trained to the left and the button is pushed when the target is on the right wire, the target will have reached "*b*" when the gun *fires* and he misses by 12 yards. (Errors double at 2000, treble at 3000, etc.) Therefore, to make a hit by using the same correction as for shot No. 1, the button should be pushed when the target is at the center of the horizontal wire.

While the firing interval is greater when using a lanyard, it is considerable when electric attachments are used and should never be neglected.

(3) Frequently men ask what effect the speed of training has on the shot. As far as the lineal movement given the projectile is concerned, it has practically no effect, and the resulting lateral error is small.

* Corrections for abeam.

The slowest possible train of the Amphitrite's turrets gives a velocity of gun-muzzle of ½ foot per second, and a lower speed of training causes a jerky movement. It is probable that the average speed of gun-muzzle is twice this or about 1 foot per second with a good man at the training-wheel.

Assume a speed of gun-muzzle of 1 foot per second and a range of 2100 yards. The time of flight (10-inch B. L. R., 30-cal., 1700 f. s.) is 4 seconds. This would result in an error of only 4 feet and may be disregarded.

The error resulting from a fast train is caused by the angular velocity of the target across the telescope field and not by the linear velocity given the projectile laterally.

Suppose the turret to be trained at a speed of 1 foot per second (speed of gun-muzzle). Knowing the distance of the muzzle of the Amphitrite's guns to be 25 feet from the center, the angle through which the turret trains in 1 second must be one whose tangent is 1/25 and the angle is $2° 18' = 138'$.

At 1000 yards the telescope cross-wires only subtend an angle of 56′—(Sine $1/2 = 8/1000$), so that if the turret moves through an angle of 138′ in 1 second, the target moves across the telescope field 138/56 times the distance subtended by the vertical wires, approximately 2½ times.

Since, from experiment, we know that the vertical wires subtend 16 yards at 1000 yards, this means that the target would move across the telescope field with an angular velocity such as to give a lateral error of 40 yards if the firing interval was one second.

Analyzing the firing of the gun so that the firing interval may be understood, we have:

Variable—

1. The gun-pointer sees the target on the wire and thinks "I will fire."
2. He pushes the button.

Constant for similar guns—

3. The primer fires, charge is ignited and the projectile starts from its seat.
4. The projectile travels along the bore and leaves the gun.

Up to the instant the projectile leaves the muzzle of the gun, the angular movement of turret affects the aiming point.

In the absence of any data regarding the firing interval, it has been found to be approximately 1/5 second, as follows:

At 700 yards' range, the average allowance for firing interval made by the members of the gunnery classes when using a taut lanyard was 5.6 yards; that is, when the target was seen on a vertical wire they thought "I will push the button."

Assuming the speed of gun-muzzle to be 1 foot per second, the tangent of the angle trained through in 1 second would be $1/25 = 2°\ 18'$, and this would result in an error of 29 yards at 700 yards ($x = 700 \times \text{Sine } 2°\ 18'$).

The average allowance was but 5.6 yards however, so that the average firing interval would be $5.6/29 = 1/5$ second.

Taking this firing interval and the angular velocity due to a speed of 1 foot per second, we find that the target would move across the field so as to cause a linear change in aiming point of $40/5 = 8$ yards at 1000 yards. To allow for this error (8 yards at 1000 yards), the button must be pushed when the target is at "*a*" for right train and "*b*" for left train (Sketch 4).

The smallest error has been considered and this does not account for wild firing in a seaway.

In a seaway there is a much greater angular velocity in the horizontal plane due to yawing and a similar velocity in the vertical plane due to rolling. Considering these in connection with the firing interval the true cause of error is found—neglect of firing interval.

Considering the question of rolling, we find that the effect is similar to that caused by rapid training or yawing. As far as the linear speed is concerned, the error may be neglected.

If we take the distance of the muzzle of a gun from the center line of water plane, we get the radius of the arc through which the muzzle of the gun moves.

For the Amphitrite's 10-inch turret guns this radius is 27′. For this class of vessel, whose period is very short, there is an extreme roll of 8° in 6 seconds. The muzzle moves 3′.77 above and below the horizontal as the ship rolls away from or toward the target. This distance is passed over in 3 seconds, so that the average speed of muzzle is 1.25 f. s. Assuming the maximum speed to be twice the average speed, or 2.5 feet per second, and knowing the time of flight for different ranges, this error may be calculated. Range 2100 yards T 2100 = 4 sec. The vertical error (due to speed of rolling) would be $4 \times 2.5 = 10$ feet.

As stated above, this error does not account for bad firing in a seaway, so that we must again refer to the firing interval. With the Amphitrite's extreme roll of 8°, period 6 seconds, the average angular velocity is 1⅓ degrees per second. If we assume the maximum angular velocity (when the ship is upright) to be twice this, we get 2⅔ degrees per second.

If the average firing interval be taken, the error in elevation due to roll would be $2\frac{2}{3} \div 5 = 32'$. If the button were pushed when the target was on the horizontal wire and rolling away from the target, then at 2100 yards, the elevation would become 2° 47′ instead of 2° 15′, and the shot would strike 450 yards beyond the target (since 2° 47′ is elevation for 2550 yards), giving a vertical error of 57 feet (Sketch 5). If the vessel was rolling toward the target the elevation would be reduced by 32′, or from 2° 15′ to 1° 43′, and the shot would strike 557 yards short (since 1° 43′ is the angle of elevation for 1543 yards).

Fortunately, there is a short period at each end of a roll when the ship is at rest. If the gun is fired at either of these times the vertical error due to the firing interval is diminished and may become zero.

Consequently, for large-caliber guns, "fire when on the target at the end of a roll."

RAPID-FIRE GUNS WITH SHOULDER PIECES.

(5) These guns are fitted with bar-sights carrying a sliding leaf to correct for speed and wind.

By experiment, it has been found (for Amphitrite's guns) that a movement of one division corrects for 3 yards at 1000 yards, 6 yards at 2000 yards, etc.

With these guns, it is comparatively easy to keep the line of sight on the target.

While the firing interval must be considered, it plays a less important part than in the case of large-caliber guns. The general rule for firing rapid-fire guns is: "Fire when on the target."

SIGHT CORRECTIONS.

As stated previously, one division on a sliding leaf corresponds to 3 yards at 1000 yards. By referring to sketch (No. 6), it will be seen that with a constant angle (α), at 1000 yards, $a - 1000 =$ 3 yards at 2000 yards, $b - 2000 = 6$ yards, etc. That is, the chord of constant angle (α) increases in proportion to the range.

For the telescope sight, where the reference is not divisions, the distance subtended by the vertical wires is used. As stated previously, it has been found that these wires subtend a chord 16 yards in length at 1000 yards range. That is, if it was desired to correct for an error of 8 yards at 1000, the target would be placed at the junction of the horizontal wire and a vertical wire. This correction, for convenience, will be taken as referring to speed alone. Since a ship moves $\frac{6086'}{60 \times 60} = 1.7'$ per second when going at a speed of 1 knot per hour, this correction of 8 yards must be for a speed of $\frac{24'}{1'.7 \times 1.83} = 8$ knots, since T 1000 (10" B. L. R. 1760 f. s.) = 1.83. Since the time of flight for 2000 yards is practically twice this (correct for an I. V. of 2000 f. s.), (3.83) and for 3000 yards 3 times (5.98), we may say "For a speed of 8 knots, *at any range*, place the target on the right (or left) vertical wire" (Sketch No. 7).

This would be true because the angle ($\frac{1}{2}\alpha$) subtends a chord of 8 yards length at 1000 yards, 16 yards at 2000 yards, and 24 yards at 3000 yards, and the times of flight increase in the same proportion. Suppose we take a vessel 48 feet long (see Sketch No. 7). At 1000 yards she would just fill the space between the vertical wires, at 2000 yards, two such vessels would be required, while at 3000 yards 3 such vessels (or one 144′ in length) would just fill this space. Therefore:

"Corrections for speed do not vary for changes in range." This rule applies to corrections for wind also. Taking the Navy Scale, the deviations * due to wind are as follows:

	Miles per hr.	Dvn at 2000 yds.
1. Light air	8	1 yard.
2. Light breeze	13	2 "
3. Gentle breeze	18	3 "
4. Moderate breeze ...	23	4 "
5. Stiff breeze	28	5 "
6. Fresh breeze	34	6 "
7. Very fresh breeze ..	40	7 "

* When direction of wind is perpendicular to line of fire.

That is, "the error in yards due to a wind blowing across the line of fire (range 2000 yards) is numerically equal to the force of the wind as recorded by the Navy Scale." For 1000 yards it would be ½ this, for 4000 yards it would be twice the amount. *This rule applies to large guns only, and at moderate ranges.*

IT IS NECESSARY TO KNOW THE RANGE EXACTLY.

(7) It is necessary to know the range exactly. Suppose the range was given as 2200 yards while it was 200 yards less, or 2000 yards. If the gun fired when the line of sight was on the target, the shot would pass 18 feet over.

Since we have no good method of finding the range in target practice, ships should be run on bearings so that ranges may be accurately given. (This applies to target practice alone.) In battle the best known method of finding a range is by using a small-caliber gun for short ranges and a large-caliber gun for long ranges.

Suppose that two ships are meeting, the range and speed correction must be determined with a large-caliber gun because it will be impracticable for individual gun captains to get their corrections later. No one can tell where his shot struck when all the guns are firing "at will," as there is no way of identifying the splash of any particular shot.

Having found the range, general rules would be:

Aim at the bow—

1. When a vessel is overhauling you.
2. Running away from you.

Aim at her stern—

1. When you are overhauling her.
2. When you are running away from her.

Aim at bow—

When two vessels are passing.

For rolling down (telescope sight)—

Fire when her masts are on the horizontal wire.

For rolling up—

Fire when her hull is above the horizontal wire.

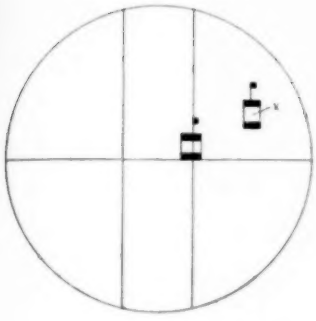
(These rules do not apply to large-caliber guns. They are for R. F. guns which handle easily.)

Since writing the preceding paper, it has been learned that Lieutenant-Commander Fletcher, U. S. N., found the average

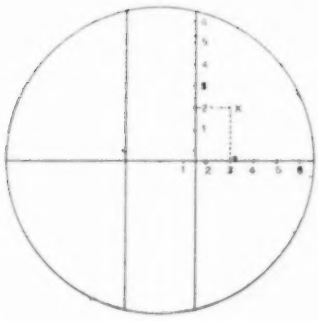
firing interval to be 3/10 second. The experiments were carried on at the Torpedo Station, Newport. This value (3/10 second), was found by making a man press an electric button at a given signal, the person giving the signal being either so placed or the signal being of such a nature that no advance information was given as to when the signal would be made.

It will be noted that what is termed the firing interval in this paper is different from the preceding, as well as from that defined in The Text-book on Ordnance and Gunnery—Ingersoll. The variable part—due to different men having different personal errors—and the constant part are not separated, and it is probable that the two combined make an interval of approximately 1/5 second, as stated.

As men gain experience and intuitively learn their corrections for this interval, their firing is improved and their mean error may be reduced to a small fraction of a second.

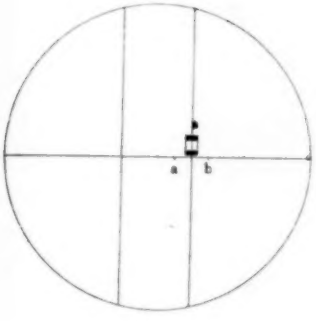


1.

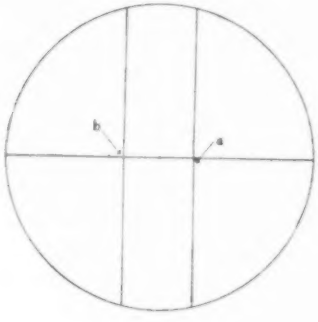


2.

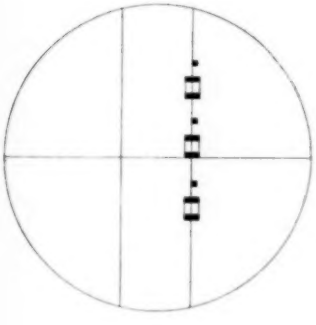
Horizontal, 1 Divn. = 5 knots speed.
All quadrants to be similarly marked.



3.



4.

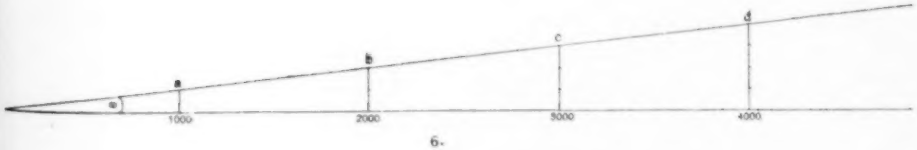


5.

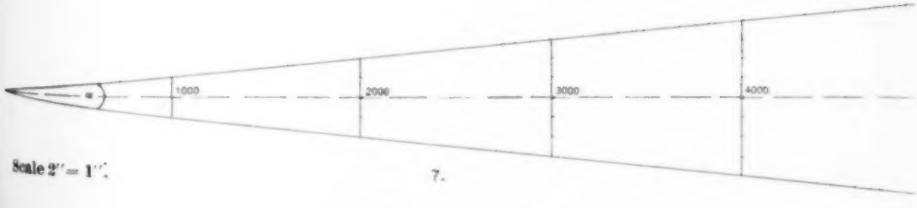
Position target when gun fires (down roll).

Position target when button is pushed.

Position target when gun fires (up roll).



6.



Scale 2" = 1°.

7.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

BRITISH CONQUESTS IN THE PHILIPPINES.

By Carlos Gilman Calkins, Lieut.-Commander, U. S. Navy.

The sordid incidents and insignificant results of the Philippine expedition of 1762 are briefly dismissed by general historians of the eighteenth century. Spanish and English writers follow the same policy of discreet neglect. Yet there were early pamphleteers who exalted the valor of the attacking forces—with a view to promoting their claim for pecuniary reward—and chroniclers of the provincial type still celebrate the devotion of the loyal Spaniards who bore a part in the defense. English admiration fell silent when the recovery of the Manila ransom was given up, but the local histories compiled to secure the propagation of loyal sentiments among Filipino schoolboys continued to invent and disseminate myths of heroic type throughout the nineteenth century. Now that Philippine conditions and antecedents have become a compulsory topic for American readers, it may be worth while to search the scanty records for parallels and precedents which may throw light on current problems. At the least, some curious illustrations of military method and political ambition in the past may be made accessible.

As a military event the Manila expedition once occupied a prominent place in the chronicles of the closing period of the Seven Years' War. Spain chose to enter the lists as a champion of the declining prestige of France under the Family Compact signed in August, 1761, to unite the Bourbon monarchs in a mutual effort to defend their exorbitant territorial claims in all parts of the world. The contest began in 1756 from the collision of French and English schemes of expansion in the valley of the Ohio and on the Coromandel coast. Before the end of that year

Braddock had been defeated, the English at Calcutta had been stifled in the Black Hole, and Minorca had been lost. These warnings made public opinion a paramount force in the conduct of the war, and a corrupt and incompetent administration was replaced by the installation of the elder and greater Pitt as virtual dictator. Under his firm hand and impetuous will the nation was organized for war, and British supremacy was vindicated wherever sea-power could control the issue. In 1759 the French navy was crippled at Lagos and Quiberon, and the capture of Louisbourg and Fort Duquesne, followed by the crowning victory at Quebec, put an end to the French dream of a North American empire. The next year's struggle wrecked French domination in India, and the last French army in Asia was routed in January, 1761.

The decision which led Spain to risk her colonial empire by coming forward as a belligerent was due to personal impulse as much as to public policy. The accession of Charles III in 1759 broke up the lethargy which had overtaken the court at Madrid during his brother's declining years. He had had to resent British threats against his Neapolitan cities in 1742, and he inherited Spanish bitterness over the loss of Gibraltar and English interference with the trade of the Indies. He appointed to his cabinet various ministers of foreign extraction; Wall, an able Irishman, was moderate or favorable to England, and soon sought retirement; Grimaldi, a Genoese, "was more French than any Frenchman," and stimulated his master's eagerness to check the growth of a power which was ruled by the purpose of seeking "expansion on land and despotism at sea." France had to be saved from the harsh measures of an "insulting victor," and enabled to keep her colonies and to maintain a navy. Spain felt that her own vast pretensions were threatened by the arrogant policy of Pitt.

In England personal influences due to the accession of a new monarch seemed to make for peace. George III, the first English king of the Hanoverian line, fell into the hands of Lord Bute, a clumsy Scotch courtier, and strove to shake off the domination of Pitt, who asserted himself as tribune of the people, as the representative of public opinion in the royal council. As prime minister he was wont to threaten his dilatory or incompetent colleagues with immediate impeachment if supplies and

troops were not ready to meet the demands of his policy. Anson sat in the cabinet as first lord of the admiralty, but he was forced to sign naval orders which he was forbidden to read. Such pressure was bound to cause reaction, and Pitt was forced out of office in September, 1761. It was reckoned no small victory for the young king and his courtiers when they got rid of the ablest war minister who has ever served England, just as he was bringing the war to a triumphant close. So much was accomplished during the first year of George III.

Pitt fell because he was impatient to begin the contest with Spain. In July, 1761, a French negotiator came to London with proposals for peace. He astonished the English cabinet by presenting demands and threats on the part of Spain—the agent of a belligerent claiming to represent a neutral power hitherto on friendly terms with England. Pitt urged the despatch of a fleet to Cadiz, where a treasure fleet was due, as a direct answer to Spanish threats. The council refused to act, and when Pitt spoke of his responsibility to the people he was told that all who sat at that table, Pitt as well as his colleagues, were responsible to the king only. This forced Pitt to resign, and his failure to appeal to the public was followed by an unbecoming acceptance of royal favor which cost him his popularity for the moment. But his plans for invading "the most assailable parts of the Spanish dominions" were executed by officers whom he had selected to command the forces prepared for expeditions beyond sea.

The view opposed to Pitt's policy was thus expressed by the Duke of Bedford, a member of the cabinet in 1761: "If we retain the greater part of our conquests out of Europe we shall be in danger of overcolonizing and undoing ourselves by them as the Spaniards have done." Moreover, the attempt to annihilate the naval power of France would unite all maritime nations against the English as seekers of a monopoly "at least as dangerous to the liberties of Europe as that of Louis XIV." Still tamer views were expressed by Rigby in correspondence with the duke: "I should not be sorry to hear that Martinique or the next windmill you attack should get the better of you." This is an un-English note, but the party of moderation was not destitute of foresight in opposing aggression or in making easy terms for the allies when the struggle was over. Dr. Gardiner, the greatest of English historians—because he is the fairest—

cannot regret the eclipse of Pitt: "He would have given England that dangerous position of supremacy which was gained for France by Louis XIV in the seventeenth century and by Napoleon in the nineteenth century. He would have made his country still more arrogant and haughty than it was, till other nations rose against it." It was Pitt's love of war rather than his skill in carrying it on that was in question. Before Pitt left the stage he rose to protest against the arrogance shown in dealing with the American colonies, though he was the last to admit the inevitable results of Spanish and French intervention in support of their independence.

As soon as the treasure ships were safe in port Spain threw off the mask, and war became a necessity. Portugal was threatened with conquest if she held to the English alliance, and some of her provinces were overrun. This invasion was not arrested without the help of English and German officers trained in the wars of Frederick the Great, who was fighting France and Austria throughout this period with results which need not be discussed here. The English declaration ushered in the new year, 1762, and Charles III replied a few days later. Whatever one may think of his arguments, no fault can be found with his command that his subjects throughout the world should be warned to protect themselves from the incursions of the enemy, and to do him as much harm as lay in their power. But we shall see that this obvious precaution was neglected, and the colonies were taken unawares.

The year opened auspiciously for England, and her progress toward maritime supremacy was unchecked by her new antagonist. Martinique was taken from the French in February, Havana surrendered in August, and Manila fell in October. France resumed her efforts to negotiate, and Spain accepted the conditions imposed by the victor; the preliminaries were signed in November, and the Treaty of Paris was confirmed early in 1763—long before any report of events in the Philippines had reached either London or Madrid.

There were manifest reasons for the choice of Manila as the object of attack. Spain was never strong in the Far East, having always been negligent or incompetent in the maintenance of sea-power. Moreover, it was reckoned that less than one-third of the inhabitants of Luzon were in subjection to Spain, and it

was well known that all her colonies were oppressed and discontented. These facts furnished support for political schemes, and there was no lack of commercial calculations and strategic speculations: "For Manila in the possession of an enterprising people is capable of ruining the whole China trade of any other, as the port of Cavite can build, fit out, and man very large ships of war, which, if properly stationed, no vessel could possibly escape, unless protected by a squadron." Again, "with Manila in our hands we might depend upon respect to our flag in the ports of the Chinese Empire." Great Britain had to send out better ships than were ever built in the Philippines and hold more convenient naval stations than Cavite before the Chinese policy of exclusion was overthrown. Shipbuilding in the ports of Luzon had been carried on for centuries before the English visit, but no vessels capable of suppressing piracy in the archipelago or escaping English corsairs in the Pacific were ever produced. Yet such were the motives for this enterprise, "exclusive of the popular and dazzling notions of booty and plunder." The influence of such notions appears in the stipulation which gave the East India Company one-third of the value of all plunder taken by the expedition in return for expenses incurred in providing equipment. This curious contract seems to have returned a fair profit to that rapacious mercantile monopoly, which had begun to seek profit through a policy of conquest.

The expedition seems to have been planned with some care; it appears that the officer chosen to command the troops had visited Canton in a frigate during 1759 for the purpose of securing information concerning conditions in the Philippines, obtaining certain general notions already cited (Annual Register, 1763). He afterwards claimed to have planned as well as executed the enterprise. This officer, Sir William Draper, was made a brigadier for this expedition and received knighthood as his chief reward for its success. He was born in 1721, entered the army in 1744, after receiving a classical education at Eton and Cambridge, married the granddaughter of a duke—a descendant of Charles II—in 1756. All these circumstances had their influence upon his career in the service. In 1757 he was appointed to command a new regiment, the 79th, recruited for the campaign in India. After serving with credit in the contest with the French in that country and visiting China and England he ar-

rived at Madras in June, 1762, to assume command of the Manila expedition.

The naval force detailed to convey the troops to the field of action and to support them in the attack was commanded by Admiral Cornish—who had to accept a baronetage in lieu of other rewards. His squadron included seven ships-of-the-line, besides frigates and storeships—an ample force, considering that no naval resistance was anticipated. The admiral took measures to intercept the enemy's despatches by sending a frigate to watch the Straits of Malacca, and another sailed for Manila to take soundings and make a reconnaissance, completing the work a few days before the arrival of the fleet. The absurd weakness of Spain appeared in the fact that this frigate was able to make this visit without explaining her purpose or admitting any official intercourse with the puzzled authorities, who were unaware of the declaration of war published from Madrid eight months before. Rumors from Batavia had been slighted, but the apparition of a mysterious cruiser led to an effort to fit out two or three vessels to secure the safety of the annual treasure ship then due from Acapulco. But this measure was not destined to take effect.

The evening of September 22 saw a British fleet of fifteen sail standing in for the anchorage north of Sangley Point. There had been delays in embarking stores and troops through the surf at Madras, and some anxiety lest the southwest monsoon might fail before the voyage was completed. But the run was fortunate, and the seamen had now to arrange to land their passengers through another line of surf on the beach below Malate. The acting governor-general of the Philippines lost no time in sending an officer to inform the English commander of the surprise caused by the presence of the fleet. The reply was delivered at the palace without delay: "The King of Spain having declared war against England, the squadron had come to conquer the city and the Philippine Islands, and that if the Spaniards were unwilling to undergo the rigor of war, they should surrender without delay." Of course, the answer was a protest against the harm that might ensue, "since the faithful vassals of the King of Spain were bound to shed the last drop of their blood rather than surrender without the royal order." It was added that the Spanish forces were in nowise inferior to those afloat, as their vigorous defense should demonstrate.

Whatever the Spanish power of resistance might be, it was in the hands of an incompetent authority. The governor-general was the Archbishop of Manila, Don Manuel Rojo, holding an interim appointment from the king. The courts had assigned the succession to a bishop, but the royal decree designated the higher prelate to assume the post left vacant by the death of General Arandia. The popular histories circulated in the islands describe the archbishop as "a feeble and irresolute American," whose weakness delivered the archipelago to the English. A more judicial writer credits him with "more energy than might have been expected from a man of his profession." But all his energies were bound to prove ineffectual.

The English force available for attacking the city included 1300 European troops—some of them Frenchmen from the army disbanded after defeat in India, about the same number of Sepoys of inferior quality, 700 seamen and 300 marines from the fleet. The defense could dispose of some 500 men of the Regimiento del Rey, a few artillerymen, 300 Spanish militia, and an unlimited supply of eager but undisciplined natives, Pampangos and Tagalos. As the town was left open until it surrendered, supplies and reinforcements continued to enter.

The first effort made by either party related to the stone fort of San Antonio Abad, a structure familiar to many Americans in 1898. Powder was manufactured in this work in the last century, and the name *polvorin* stuck to it long enough to provoke inquiries and reports from our consul prior to the advent of Admiral Dewey's fleet. But in 1762 there was really a store of powder, most of which was removed before the English landed. There was much debate as to whether the rest should be used to blow up the battery or to fight its guns. The party in favor of fighting won the vote in council, but the detachment sent to man the works arrived too late. The English landed on September 23, and lost no time in occupying the fort and exploring the adjacent suburbs. The belated garrison of San Antonio and other stray detachments were promptly driven in until everything along the beach was abandoned, the English advancing through Malate and Ermita, and the Spanish retiring within the walled city. North of the latter suburb lay two villages grouped around the massive churches of Santiago, which stood near the beach, and San Juan de Bagumbayan further inland. At some

later period these masses of buildings were cleared away to make the present promenade which the Filipinos call the field of Bagumbayan—and might call the field of blood, since it was stained with the murder of Rizal and other patriots in 1896 and 1897. But the English attacking force found cover in the houses, and made fortresses of the churches, both of which appear to have stood within 500 yards of the city wall.

In advancing their batteries the English frankly disregarded the strict rules of attack as understood in those days of ineffective artillery. They found the enemy slack and unready in his plans of resistance. Nothing had been attempted while the invader was landing his troops, but sorties were ordered after he had found cover in stone buildings close to the walls. These sorties were made at night whenever a body of Filipinos could be stimulated to undertake them. The first was made on the night of September 25. The Spanish detachments withdrew, but "firing lasted all night without much results for anybody," a phrase which recalls the summer nights of 1898. Another useless sacrifice occurred two days later, but the grand and final attempt took place on the morning of October 3. Three columns, containing altogether 2000 Pampangos and 200 Spaniards, sallied forth before daylight, but their shouting and beating of drums made a surprise out of the question. The attack was vigorous, however, and the English—or rather the Sepoys—were driven from the church of San Juan. The natives climbed the tower and began to ring the bells. The besiegers rallied and drove back their assailants. Had the natives had skilled leaders and better arms, a temporary victory might have been won by hand-to-hand fighting.

The impression produced upon the minds of English officers deserves our notice: "It is somewhat remarkable that the Asiatique Indians of the peninsula of Malacca, and, in general, of all the islands, should differ so extremely from the Chinese and every other nation of the Eastern Continent. The former are as distinguished for their fierce valor and for a singular contempt of death, as the latter have always been for their cowardice and for the softness and effeminacy of their manners. In our wars on the Indian Continent, the European troops were almost the only object of attention. In our attack upon the Philippines, the natives were at least to be equally dreaded. In this sally, had

their discipline or their arms been at all equal to their strength and fierceness, the issue of the event had been very doubtful." It is to be remembered that these are the words of Edmund Burke, based on the reports and opinions of General Draper.

The English lost about forty men in this night attack, and the Spaniards seventy. As for the Filipinos, no quarter was given, and some hundreds were slain, all prisoners being hung at once. This atrocity seems to be associated with the slaughter of a British officer under a flag of truce by a band of natives close to the walls of the city. Draper had already warned the archbishop that obstinacy might lead to barbarity on the part of some of the English troops who might not submit to restraint. It is to be assumed that he meant the Sepoys, though the phrase had a wide application in both the hostile armies.

By this time the English had a breaching battery of 24-pounders playing on the south bastion, and a group of mortars behind the church at Santiago, throwing shells into the city. The admiral placed his flagship opposite the southeast bastion, and stationed other vessels off the mouth of the Pasig to fire at Fort Santiago, the citadel on the river bank. The fleet had to lie in deep water, and its solid shot were ineffective when fired at high angles. The Spanish had plenty of guns—most of them cast at the foundry (*fundicion*) which gave its name to the southeast bastion—but their return fire was altogether ineffective. They seem to have neglected the ships while trying to keep down the fire of the siege batteries. But the breach was widening day by day, and many guns were dismounted along the wall. Since the failure of the last sortie, the defense grew hopeless: "Any other people but the Spaniards of this garrison would have capitulated, or would have posted men to resist storming." Their pretended resolution was nothing but "sullen obstinacy, uninspired by a true military spirit, as it was wholly uninformed by any true military skill." Yet the archbishop consulted his council daily, hearing the advice of the courts and the clergy as well as that of officers and engineers.

On the morning of October 6, the breach having been reconnoitered and found practicable, a storming party of 400 men was led forward by Major Fell. They found the breach unguarded, and were able to advance up the Calle Real without opposition, halting to clear the cross streets and silencing small-arm fire from

the houses by shooting or bayoneting their occupants. One group of a hundred is mentioned as thus throwing away their lives. The archbishop and his council, as well as most of the Spanish troops, were shut up in Fort Santiago. Consent was refused when it was proposed to fire a field-piece down the street against the head of the advancing column. The day before the assault, an order was issued by the commandant of the garrison warning the monks to forbid the natives from manning the walls. The officer commanding the king's regiment ran off, followed by most of his men. The only hero of the defense was an Irish pilot, Raimundo Kely, as the name stands in the chronicle, who died bravely in the Carranza bastion. Some hundreds are said to have been drowned in the Pasig during the panic which preceded the capitulation.

The governor lost no time in sending out his terms of surrender. These being found unsatisfactory by General Draper, the archbishop and his general were summoned to leave the fort and present themselves at the palace where they were forced to accept whatever the English chose to offer. The archbishop had asked for the free exercise of religion, protection for life and property, the honors of war and back pay for the garrison, free trade between the city and country, and the maintenance of ecclesiastical and civil government on the existing basis. For these favors he offered a ransom of $1,000,000.

The English terms made the officers prisoners on parole, required the surrender of artillery and ammunition, of the port of Cavite and all forts in the island. The privileges demanded would be allowed upon payment of $4,000,000, half in cash and the rest in valid drafts. It is said that threats of general slaughter were employed to enforce acceptance of these terms. At any rate they were signed, and the city was delivered to the English on October 7.

In spite of all promises, pillage seems to have followed the English occupation. There is the usual tale of atrocities, houses plundered and all that could not be removed destroyed, women mishandled, churches desecrated and stripped of plate and vestments. It is all only too probable, but the Spanish writers admit that it was over in three hours, that the English soldiers were rather predatory than cruel—though the Sepoys are said to have amused themselves by inflicting tortures—and that Chinese robbers were

put to death, Draper shooting one of them himself, and directing the hanging of two more. The public archives and much private property were burned. In all forms of mischief, the native servants and the levies of Pampangos and Tagalos were foremost. When Draper decided to banish all Filipinos from *Intramuros* the suburbs were likewise looted. There is said to have been a renewal of license on the second day for a fixed period, and sporadic cases occurred until the invaders withdrew. The port of Cavite was delivered to the English after the natives had been allowed to pillage the arsenal. With all the license granted the conquerors, there was plenty of soldierly grumbling: "The General's Latin cost us our looting," growled those who had heard that the capitulation was drawn up in the language befitting a churchman and a scholarly commander-in-chief engaged in diplomacy.

The political attitude of the British and their relations with the Filipinos must now be considered. The first statement of their intentions appears in a joint proclamation from Draper and Cornish, issued from H. B. M. S. Norfolk, on September 24. The natives were warned against assisting the Spaniards, and were offered protection and relief from the heavy taxes imposed upon them; "we are here to deliver your country from ruin and your wives and daughters from dishonor." A promise to pay fair prices for all stores brought in was, perhaps, of more practical effect than any assurance that the English had come to relieve the natives from toil and to make war on the Spaniards only. After some opposition on the part of the Spanish authorities the archbishop and magistrates were made to sign a deed of cession, transferring the whole of the Philippine Archipelago from Spain to Great Britain. Circumstances prevented any decision of the validity of such an instrument, but the Spanish community seems to have refused obedience to the governor's order that the British domination should be accepted.

Incessant annoyance was the fate of the Spanish officials charged with the collection of the two millions due as a part of the ransom. The immediate demand for a million was met by the payment of only $700,000, raised by a general contribution, which stripped merchants of their goods and churches of their plate and ornaments. The annual galleon from Acapulco was due, when the place capitulated, with silver to pay for the Chinese

goods which had made up her eastward freight and coin for carrying on the government of the Philippines, which was then dependent on Mexico. The treasure ship was the Filipino, and stipulations were made for the payment of the ransom from the bullion on board. But the silver was landed before it could be secured, and the ultra-patriotic element which had taken to the jungle refused to allow it to go to Manila when the archbishop sent orders to that effect.

Early in October the ship Trinidad, outward bound from Manila, was captured by two frigates and brought in as a prize. Her cargo showed that she was freighted for Mexico, and there was little money on board. She was pierced for sixty guns, but only six were mounted. During the action she had relied on the thickness of her sides to keep out the enemy's shot, and had made little effort to return his fire. Heavy tropical timber was used in all ships built in the Philippines, making them sluggish sailers, with considerable defensive strength. These conditions had regulated naval tactics in the seventeenth century when the galleons were threatened by the Hollanders or by English buccaneers, but they had failed to save the famous prize taken by Lord Anson near the entrance of San Bernardino Strait. The Trinidad with her cargo was appraised at $3,000,000, and she was purely a naval prize. Yet the Spanish authorities tried to set off her value against the unpaid ransom, and recent writers persist in confounding her with the Filipino to sustain that theory. The richest prize of 1762 was the Hermione, taken off Cape St. Vincent with $5,000,000 in treasure at the completion of her voyage from Lima. This capture gave a handsome fortune—for that age—to the captain, and each of his officers won a competence.

Five weeks after the capture of Manila, General Draper turned his conquest and its coming problems over to a Mr. Drake, who was appointed as deputy governor as an agent of the East India Company. The garrison was commanded by Major Fell, and a naval officer was governor of Cavite. Sailing from Manila with the northeast monsoon on November 11, Draper reached London on April 4, 1763, making the run in the remarkable time of 144 days and bringing the first news of his conquest—news which had lost all importance and most of its interest through the negligence of the ministry in its "headlong eagerness for peace." Draper seems to have been promised the next red ribbon of the Order

of the Bath, and he secured some honor at Cambridge by presenting the Spanish standards captured at Manila to King's College, of which he had been a fellow. The banners were carried in procession and fixed to the altar rail of the stately chapel of that college, where they are still preserved. The general built a mansion near Bristol and named it "Manila Hall," but he did not outgrow his grievance over the loss of the ransom, nor did he develop a capacity for dignified retirement.

The Treaty of Paris (January, 1763) took no account of the Philippine situation because of the "shameful omission of any provision relating to conquests made and not known before preliminaries were signed." Such omissions are still made, however, in spite of historic warnings. In the matter of conquest England was not in an exacting mood. France gave up the right to keep up a military establishment in India, and ceded Canada to Great Britain and Louisiana to Spain. Cuba was restored to Spain, and Florida went to England in exchange. Thus the North American continent was freed from any power capable of interfering with the progress of the thirteen colonies, and the connection with Great Britain ceased to be of vital importance to those communities. Martinique and Guadeloupe went back to the French, much to the disgust of Pitt, who insisted that England should hold these islands for the sake of exclusive trade: "All that we gain on this system is made fourfold to us by the loss which ensues to France." This ill-tempered notion has been long rejected by England, though France seems inclined to let it pervert her eager colonial policy in Madagascar and elsewhere.

Among the irritating claims put forward by England as the result of her maritime supremacy was one restricting the trade of neutrals with the colonies of a belligerent. Only the usual commerce carried on during peace was tolerated, and neutral property under a neutral flag might become lawful prize when captured on the high seas without regard to blockade or to the character of the goods. Thus, the French effort to enable colonies to sell their products was defeated by decisions referring to restrictions imposed on the trade of her colonies previous to the declaration of war in 1756. Forty years later this harsh rule was applied to destroy American commerce in the West Indies. English and American authors seem to admit this principle as a part

of marine international law, though continental jurists oppose its acceptance. If it has to be admitted, the best remedy for possible hardships in its application to remote possessions would seem to lie in the removal of restrictions during peace. Thus, the extension of some sections of our navigation laws to oversea possessions would cripple commerce during a contest with a maritime power.

There was no lack of exasperation against England's belligerent claims and methods in 1763. Spain had succeeded in taking the Portuguese colony of Sacramento on the Rio de la Plata when she was called upon to resist a buccaneering attack upon Buenos Ayres. This is the story as printed in the "Annual Register": "Having made ourselves masters of the Havana, and taken measures for the conquest of the Philippines, it was judged expedient to encourage some private adventurers to add to our other operations against Spanish commerce an attack upon the colony of Buenos Ayres." Captain Macnamara, "an adventurer of spirit and experience," was made commodore of the squadron, and was defeated and slain with most of his mixed company of Portuguese and English on January 1, 1763, his flagship being sunk by Spanish guns. Other vessels of his fleet brought home intelligence of the failure of this tardy and discreditable enterprise.

The episode of the Falkland Islands showed the irritation produced by these attacks. Lord Anson had indicated the value of these islands as a naval base whence Spain's domination in the Pacific might be threatened. When it was proposed to take possession in 1748, the Spanish ambassador, Wall, though favorable to England in general, had to announce that intrusion into the South Seas would be regarded as an act of war. Yet a garrison was sent out in 1765. Four years later Spain demanded evacuation, and in 1770 a Spanish squadron carried away the garrison as prisoners. Charles III had to disavow this act, and he nursed his resentment until the war of the American revolution gave him a chance to lower English prestige.

Great Britain had other motives for coming to terms with her foes than a regard for their future hostility. The draught of the king's speech, prepared by Bute, deplored "the bloody and expensive war," which was consuming the resources of the nation. The phrase was modified but the fact remained. No less than

110,000 soldiers, besides a large army of German auxiliaries, and 70,000 seamen were employed. The whole number of seamen enlisted or impressed during the Seven Years' War amounted to 180,000, of whom less than one-third were ever regularly discharged. Death and desertion are supposed to account for more than 130,000 of these recruits. Yet few had fallen in battle, though disease had swept away thousands under the walls of Havana. The appropriation for the last year of the war fell little short of $100,000,000, and the struggle lasted long enough to double the national debt—a result which was repeated twenty years later when the American colonies secured independence.

In spite of these burdens the national pride was offended by the tame acquiescence of the government in Spain's refusal to pay the Manila ransom. Pitt was the organ of such sentiment whenever he could score against his successors: "How can you depend upon Spain after the treatment she has shown to that brave and gallant officer, who has suffered for his lenity towards them at the Manillas and now feels their perfidy?" Conway and Grenville used similar arguments to annoy each other—each criticising the slackness of him who happened to hold office. Grenville was accused of becoming the advocate of Spain, but he said he only repeated their arguments by way of explanation.

The Spanish refusal was natural enough to dispense with elaborate arguments from the king's advisers. Grimaldi told the British envoys that the promise of a ransom in lieu of plunder was void because pillage was only an abuse in modern warfare. Moreover, the bonds were extorted by force—to which the reply was made that it was so with all the articles of any capitulation—and that, "in the same fashion, the Archbishop might have stipulated in the king's name for the surrender of the province of Granada." When he added, "My master would fight forever rather than consent to pay a single doubloon," a peaceful ministry had to drop the subject. Finally, Draper and Cornish were told by Lord Shelburne, then prime minister, that their rights had to be sacrificed to the public interest and to national convenience. Up to this time Draper had been as eager as the amount involved—$125,000 for the general and the same for the admiral—would suggest. He had published a pamphlet refuting the Spanish pleas, summarizing the case in the title: "Colonel Draper's Answer to the Spanish Argument Claiming the Galleon

and Refusing Payment of the Manilla Ransom from Pillage and Destruction," (1764).

Unfortunately for Draper, he could not confine his literary talents to appeals of this nature. In 1769 the shadowy Junius—Lord Temple is now the favorite among those concerned in conjectural identifications—began his career by an attack upon the commander-in-chief, the Marquis of Granby. Army reform is a topic of perennial interest in England, and Junius created something of a sensation. Draper, vain of his scholarship and of his intimacy with Lord Granby, a "fatal friendship," Junius called it, undertook the defense of his chief, with the usual apparatus of classical quotation and invective. Lord Granby was charged with selfishness in providing for his family by promotions and favors. His advocate had no patience with this: "How are any man's friends and relations to be provided for, but from the influence and protection of their patron?" Junius had mendaciously called this being "generous at the public expense."

But the unknown promptly turned his weapons from Granby to Draper, who found himself accused of "servile submission to the reigning ministry" and of selling the companions of his success. He was urged to reveal his motive for betraying his fellow soldiers: "Was it the blushing ribbon which is now the perpetual ornament of your person?" Draper replied that ministers had told him that "they could not think of involving this distracted nation in another war for our private concerns." "Although I may lose five and twenty thousand pounds by their acquiescence in this breach of faith by the Spaniards, I think they are in the right to temporize, considering the critical situation of this country, convulsed in every part by poison infused by anonymous, wicked, and misleading authors." Junius, always well informed about the affairs of the army, brought up a transaction by which Draper had effected some sort of exchange—apparently not profitable to himself—and asked spiteful questions: "Was it decent, was it honorable in a man who pretends to love the army to make a traffic of the royal favor and turn the highest honor of an active profession into a sordid provision for himself and his family?" Draper could find no rhetoric adequate to his opponent's crimes, and had to fall to challenging him to drop his mask and fight a duel. Of course Junius made it obvious that an anonymous writer was not bound to reveal him-

self to every antagonist whom he defeated in argument, and the veil was never withdrawn.

Draper became a major-general in due course and a lieutenant-general before he died. He travelled in America, and formed a colonial connection by marrying as his second wife a Miss De Lancey of New York, who got an Irish pension in spite of the wealth of her family. To this connection may be attributed the rumor that Draper was to go out as second in command in America in 1774, when Walpole noted him as "writing plans of pacification in our newspapers." Instead of attempting the execution of futile schemes in America, he took the post of lieutenant-governor of Minorca, and endured the siege of 1781-2. England could not afford to relieve the place, her forces being fully occupied in threatening America and holding Gibraltar. The island was offered to Russia as the price of an alliance. Finally it was surrendered and made a permanent possession of Spain. Upon his return to England Sir William Draper preferred twenty-nine charges against the governor, General Murray. All but two of these charges were held to be "frivolous and ill-founded" by the court-martial, which dictated mutual apologies for the two generals. Murray was obstinate. Draper, "though the greater Bedlamite," according to Horace Walpole, signed submissively. He had also to endure a royal reprimand for his factious conduct. As a man never at a loss for grievances, he appealed for further recompense, stating that his position at Minorca, his share of the Manila ransom, and his wife's fortune—confiscated by the Americans on account of the loyalty of her family—"had all been sacrificed to save the country further effusion of blood and treasure." With his claims still unsatisfied, Sir William Draper died in 1787.

For the Manila ransom, Spain never made a better offer than that of leaving it to the arbitration of Frederick the Great—an offer unacceptable to England. Before the end of the century, a Spanish historian of the Philippines spoke of the matter as buried in oblivion, "covered by the millions sacrificed in the treaty relating to Nootka Sound and the whale-fisheries on the northwest coast of America." Yet a dim notion that England had some sort of a lien on the Philippine Archipelago was found prevalent in Hongkong in April, 1898.

It is time to return to Manila, and to consider the state of the

derelict provinces of Luzon during the miserable period of anarchy which lasted eighteen months after the formal suspension of hostilities in Europe. There was no lack of rival authorities and contending jurisdictions during this unhappy interval. In Manila there was an English governor, whose pretensions were opposed by successive military commandants, the last of them describing Governor Drake as "ignorant of every branch of military service, custom, duty, or order." So much seems to have been proved, and there are accusations of much that was worse than ignorance. As a convenient agency for disseminating the decrees of the British rulers, the archbishop and his council were guarded in the capital, and made to assert a spectral authority. Then there was a judge of the supreme court roaming about the adjacent provinces, carrying on guerrilla warfare, and calling himself governor and captain-general.

This troublesome personage was the notorious Don Simon Anda y Salazar, whose legend is recorded on the monument, now familiar to so many Americans, on the promenade outside Fort Santiago on the bank of the Pasig. The legend is amplified in various works printed for use in the Philippines; the school history credits "this vigorous and prudent old man" with nothing less than reconquering the island. The "Official Guide" says that he showed the British army how hard a task it was to subdue lands "sheltered under the shadow of the Spanish flag." With the aid of friars who preached the holy war and natives who rushed to join the improvised armies, led by their pastors, the situation of the English became so desperate that they were lucky in escaping from "a country which had cost them so much blood, and in which they dominated no more soil than they stood upon." It may be profitable to examine the facts relating to the elements of this truculent tradition.

Anda quitted Manila shortly before the surrender in October, 1762, in a "frail skiff," carrying $5000 in silver and a couple of quires of stamped paper—always an essential of Spanish sovereignty. As the city was not beleaguered, there was no difficulty in escaping. Professing to interpret the law, being the only active member of the court outside the enemy's control, Anda declared himself governor-general, alleging that the archbishop's surrender was equivalent to abdication. Possibly he had the law on his side; questions of succession in Spanish colonies

are too intricate for lay discussion. In fact, the courts were in difficulties over most vacancies in the Philippines. One rule has been settled during the present century; Rear-Admiral Don Patricio Montojo relates in his autobiographical novel, "Leon Aldao," that he had to correct Lord Elgin's impression that a prelate might become a governor, when the English diplomatist visited Manila about 1860. The main object of Anda's assumption of authority was to nullify the deed of cession for the whole archipelago which the archbishop had been forced to sign. To make this cession effective, letters were sent out from Manila, urging all officials and the clergy to render obedience to the English government until peace was made. Even private persons and natives received such letters, bearing the signature, "Manuel, Archbishop-Governor and Captain-General of the Philippine Islands." The unhappy prelate retained his titles throughout the year 1763, and no solution could be found for the conflict of authority until he died in January, 1764.

The English troops began operations to extend their conquest in November, 1762, by sending out a flying column to seize the town of Pasig as a base of operations for controlling the provinces of Bulacán and Laguna. The place was carried after some resistance, in which the Sultan of Sulu and his son, held captives by the Spaniards, bore their part. The town was intrenched with the convent as its citadel, and the post was held until the evacuation of the island, a fact showing the weakness of the Spanish organization for checking invasion.

Hearing that the town of Bulacán was to be fortified as Anda's capital, the English commander sent out a force to attack that place in January, 1763. The column embarked in boats to the number of 1800, 400 English soldiers and 300 Sepoys with a following of 1100 Chinese, 600 of whom are said to have been armed with pikes or bolos, the rest serving as porters. After landing at Malolos, where a small garrison was left, the main body marched to Bulacán. There the church and the adjacent cloister were found intrenched and guarded by seventy Spaniards and 1500 Filipinos with five small cannon. Busto, the most active of Anda's officers, his so-called lieutenant-general, was busy in annoying the English outposts and threatening the lines of communication. Three storming parties went forward before the convent could be carried. The guns were silenced,

but a brisk fire from musketry and bows preceded the hand-to-hand struggle in the church. The alcalde of the province, a Recoletan friar, and several Spaniards were slaughtered. Spanish writers—no others report this affair—accuse Major Slay, the English commandant, of turning a number of the wounded over to his Chinese followers, who finished them with tortures. The English troops spent nearly three weeks in Bulacán, where they were joined by the garrison left at Malolos. Then the column returned to Manila.

Busto collected bands of natives, and annoyed the detachments sent out to forage and the pickets in the suburbs of the capital. Much skirmishing went on over the church bells of outlying parishes, the Spaniards trying to carry them off to be cast into field-pieces and the English fighting to bring them in as trophies. Much marching and countermarching was done to secure the treasure from Mexico, which had been landed on the south coast of Luzon from the galleon Filipino. It was moved from one convent or cave to another, and the friars and guerrillas kept it from falling into the hands of the English, though Captain Backhouse stated that he was on the point of capturing it at Lucban when he was recalled to Manila by a senseless order from the governor. The captain had to fight, occasionally with the enemy a hundred to one, but throughout most of his marches in the provinces of Laguna, Batangas, and Cavite he found the natives ready to acknowledge King George as their sovereign.

While these operations went on in the field, a more virulent and persistent warfare of proclamations and menaces was waged between Anda and Drake, representing the militant authority of Spain and Great Britain respectively. One month after the capitulation, the Filipinos were warned not to obey Anda, who had broken its articles and was therefore declared a rebel against both sovereigns. Filipinos who lived peacefully were promised protection and liberation from Spanish oppression, but otherwise they would be treated as rebels. It is reported that Governor Drake offered a reward for the delivery of Anda, "alive or dead," and it is certain that Anda offered $10,000 for Drake or either of his councillors under the same conditions, denouncing them as "tyrants, common enemies, and unworthy of human society," epithets not unlike those

which greeted the invasion of 1898. But, in the eighteenth century, the British and Spanish vocabulary was alike in ill-tempered violence.

There were other influences tending to make warfare malignant, which must be presented in the words of a Spanish writer, the Marqués de Ayerbe, whose narrative is based on a contemporary manuscript. After noting that some friars had stirred up the natives against their masters, he adds the following: "On the other hand, some friars, exalted by patriotism, got rid of their tonsure, changed their monastic habits for uniforms, and, having themselves called generals or by other titles, came into the regions adjacent to Manila and Cavite, leaving nothing in the way of supplies on the estates, under the pretext of thus depriving the enemy, the fact being that, though the other side might receive some damage thereby, much more harm was heedlessly done to the Spaniards, and especially on account of the sort of people who made up these bands, since the greater part of them had been prisoners in the jails as robbers and highwaymen. It is sufficient to note what they did with a poor curate of the Company of Jesus, whom they maltreated horribly and came near hanging, because it was pretended that he was a traitor who supplied the English, pulling down the house of the Jesuit Fathers when they set him free. The sober and judicious part of the friars could not behold without great pain all these excesses, and they tried to assert themselves, punishing as they might those who were guilty, but for lack of force it was impossible to find a remedy."

It is not surprising to learn that the English dealt roughly with those members of the religious corporations who fell into their hands. The Augustinian convent in Manila was pillaged, and the prior was kept in solitary confinement. The friars connected with the University of Saint Thomas and the College of Santa Cruz were also arrested. The usual charges were those of inciting soldiers to desert—there were many Frenchmen in the detachments from India—sending intelligence to Anda, or receiving letters from him. For the latter offense one of the judges of the supreme court was tried by court-martial and sentenced to death—a fate which he escaped by paying $3000 to the British governor with a promise to make up $10,000 in all. This sordid fact is a matter of record, since the money was

returned in 1764 through the efforts of officers more scrupulous than the governor. Other extortions were practiced through the agency of petty courts established in Manila. Spaniards and natives of all classes were charged with sedition, heavy penalties were awarded, and the victims were ransomed for cash or jewels. Thus the medals and trinkets worn by Filipino women were collected by officials. These details are derived from the testimony of a British officer in a letter to his superiors.

Naturally there was great demoralization among the Filipinos. Some asserted their good will toward the Spaniards, and helped them in seeking refuge in the interior, but even these generous persons were apt to seize opportunities for robbing or insulting defenseless wanderers, justifying acts of violence in the name of the King of Spain, and accusing the Spaniards of betraying the capital to the English. Others invoked the name of liberty, and it was noted that a few priests and friars preached sermons inciting the natives against the Spaniards (Ayerbe). Those in charge of rural parishes were in a most trying situation: "If they abandoned their flocks, it was said that they allowed the fire of rebellion to spread; if they staid at home they were deemed accomplices, if not killed on account of respect or because a confessor was wanted" (Zúñiga).

The natives who lived near Manila were no less troublesome to the English than those in outlying provinces were to the Spaniards. In summing up the losses of the invaders, allowance was made for those cut off by the inhabitants, "who availed themselves of the slightest carelessness on the part of the English soldiers to assassinate them, and whenever a straggler or a drunken soldier was found he was put to death and buried." Padre Zúñiga shows the origin of a disposition to commit such atrocities: "The religious orders had cooperated very considerably with Señor Anda, in enabling him to maintain the Indians of the respective districts in obedience to his orders, by inspiring a horror of the English as enemies of the King and their religion, exciting them even to die in fighting cheerfully against them." But the exactions of the British, combined with severities ordered by Anda, would account for

a general dissolution of social order. The garrison was bound to have supplies and was willing to pay for them; the Spaniards killed all who were caught trading with Manila; any native found with rupees in his pocket was doomed.

But the Filipinos had political aspirations as well as predatory instincts, and the rebellion of the Ilocans deserves separate treatment. The alcalde who ruled the region around Vigan had harassed the natives by his activity and his avarice, "the ordinary vice of alcaldes," until the province was ripe for rebellion. The news of the fall of Manila was followed by contradictory injunctions from Anda and from the archbishop, to whose party the alcalde was inclined. Anda fiercely threatened the punishment of traitors for those who communicated with the English or with the archbishop while he remained in their hands. The natives began to form camps and take arms on the pretext of repelling invasion, and they were ready to cast off allegiance to Spain as soon as a leader came forward.

The man of the hour turned out to be Diego Silán, born in Pangasinán in 1730. He had served in convents during his youth, and was familiar with pious practices and mystical terms, which were of great use to him in his career as a revolutionist. He had been shipwrecked among savages, and was reckoned somewhat of a magician. He took up the business of carrying letters and parcels between the capital and the northern provinces. His journeys gave him a wide circle of acquaintances, and his fidelity to his charge made him a man of importance. The levy of Ilocans was made on the pretense of defending the province from the British attack. No more tributes were to be paid to Spanish officers because they had failed to guard the country. The arrest of the meddlesome alcalde was followed by the imprisonment of a bishop and a number of friars, and by the pillage of convents. The purpose of the rebels was declared to extend to the liberation of the natives from oppressive taxes and forced labor and the expulsion of all Spaniards and *mestizos*. Silán took the title of chief-captain, reserving that of general for "the Nazarene Jesus." His officers were commissioned to serve in "the guard of the royal banner of the sacred peace of the Christian prince" of that name, and all his orders were full of mystical confusion. It is to be noted

that he was not a native of the province which yielded to his assumed authority, and it is plain that the people must have been ripe for rebellion.

Anda sent a missive from Apalit, summoning Silán to cease his rebellion; otherwise, "I will send the Catholic army to subdue the province with fire and blood." This warning came in February, 1763, and the next month saw Silán committed to the cause of the English. He told the Ilocans not to believe the Spanish story that Manila and Cavite had been recovered, adding that the conquerors were advancing inland and were already obeyed by the Tagalos and Pampangos. They were kinder to the Indians than the Spaniards had ever been, freeing them from oppressive tributes. Two cargoes of provisions were sent to Manila with letters and presents from Silán, who assured the English governor that he would henceforth dedicate himself to the service of King George. The alliance was accepted, and arms and other presents were sent to Silán, who proclaimed himself alcalde for his Britannic majesty. Captain Brereton, the senior naval officer and governor of Cavite, addressed him by this title on May 6, 1763, promising help and arms and actually delivering a little bronze cannon. The Ilocans were urged to trade with the forces holding Manila.

But the rebellion was drawing toward an event which ruined its organized activity. Before May was over Silán was assassinated in his own house by a *mestizo*, whom the captive bishop had blessed as he set out to make the attempt. The clergy were liberated from imminent danger by the death of Silán, and celebrated a *Te Deum* thereafter. The insurgent army fell to pieces upon the loss of its leader and the era of vengeance soon began. There was an intermediate stage of petty civil wars, the Spaniards having incited the men of Amianan to attack Vigan, and the rebellion rallying under new chiefs again and again. The Spanish columns were slow, since their general was wont to retire to a safe distance from the scene of action, in accordance with a military regulation, "which he observed with exactness, as though he were fond of it," says the friar who kept the chronicle. The purpose of the regulation was "to preserve the understanding and other powers free and clear for taking the necessary measures without disturbance from fear" (Vivar).

When the fighting men were scattered the gallows had its day in Vigan. Only three were actually put to death by hanging, the widow of Silán and two of his officers. For lack of skillful hangmen the commanding officer had to build a pen in which the rebels could be conveniently slaughtered, before their bodies were displayed on the gallows. This device enabled him to get rid of ninety. Others were held in prison; many were released—after a sharp flogging. During the rebellion certain heathenish ceremonies had been revived. Since two hundred years of Christianity had not obliterated these customs, the chronicler felt constrained to suggest a remedy: "If the Ilocans saw a couple of old women hung up in their towns now and then, I am sure that they would leave off their rites." There would seem to have been no lack of such object lessons during the two years which followed the death of Silán.

After Vigan had been punished the rest of the province was overrun, and the rebels were driven to the forest, whence they were hunted during campaigns lasting until March, 1765. The bands employed in pacifying Ilocos reported that they had killed about 10,000 insurgents, with a loss of seventy Spaniards and twice as many "loyal" natives. The returns showed a total diminution in the population of the province to the figure of 26,000—the difference between that and the estimate of slain being due to starvation, emigration and other causes. The decrease of population in Cavite province in 1897 was apparently somewhat greater than the estimate cited for Ilocos. Bands of Ilocans were levied in 1764 to complete the conquest of Pangasinan. They fought without pay or rations, but they brought back the horses and *carabaos* of their rebellious brethren when the campaign was over. Yet the chronicler complains that the rebels were made equal with the faithful: "Towns which tore out their entrails to shake off the Spanish domination were treated as well as those which did likewise to maintain the Spaniards in power." Of course, the British made no effective protest against the slaughter of Silán and their other allies. They lacked force to invade the northern provinces of Luzon, and neither diplomacy nor humanity had much to say during this interregnum.

The English had employed Chinese on their expeditions,

arming them and allowing them to pillage, according to Spanish accounts. The Chinese of Guagua in Pampanga province, to the number of 900, fortified themselves and defied the Spanish power in November, 1762. Anda promptly attacked their trenches and killed some hundreds of them. He then ordered the slaughter of all the Chinese in the island. Much zeal was shown in the execution of this mandate for a while, and some thousands perished before the loyal party wearied of the sport. The massacre was not to be compared with those of the seventeenth century, however, since tens of thousands were cut off after the insurrections of 1603 and 1639.

In July, 1763, six months after the treaty of peace had been signed, a report of the suspension of hostilities reached Manila. In any other part of the world an armistice would have been arranged, but there was too much political confusion and corruption in the Philippines to allow this. The British government had made no provision for restoring the conquest, and there were no despatches from Spain. Anda refused to notice communications sent through the archbishop, and he rejected documents addressed to him as commander-in-chief of the Spanish forces, claiming the title of governor-general as a preliminary to any negotiation. He would not allow British officers to bring proposals to his quarters, saying that they would make reconnaissances. Drake declared that Anda would be responsible for bloodshed that might occur in future. Anda replied that the responsibility rested with those who neglected the forms due him and thus impeded an arrangement. He also circulated rumors that the articles of peace were forged and did all that he could to protract the petty strife and the miseries of the colony. On the other hand, an English officer reported that every appearance of reconciliation was opposed by Governor Drake and his creature because "war was their harvest."

So there was no peace in the Philippines in 1763. Anda moved his camp to Polo, only three leagues from Manila, and stirred up the natives to harass outposts and cut off foraging parties—the only expeditions sent out by the garrison. Finally, the poor archbishop died, and the British addressed Anda as Governor after January 30, 1764, thus securing a suspension of hostilities. Anda demanded the immediate evacuation of Ma-

nila, and the withdrawal of the British to a camp of his selection. Naturally this proposal was declined, and Manila and Cavite were held as firmly as ever, even the churches of Cavite being invaded and stripped of their ornaments. In March a conference between British and Spanish commissioners was inaugurated at Tambobong (Malabon), but before anything was settled the meeting was dissolved. The order for evacuating the Philippines had come at last, and the English began to collect supplies for the voyage, demanding assistance from the Spaniards to expedite their departure. They were told that scarcity to the verge of famine had resulted from the war, and many impediments were thrown in their way. Fort San Antonio was surrendered to the Spanish on May 26, and the forces of Anda entered the city on May 31, with salutes and a *Te Deum* in the cathedral.

The Spanish frigate which brought letters from Madrid arrived on March 15, after a voyage of 83 days from Acapulco, bringing also a new governor commissioned by the king. Governor Torre had the discretion to be ill on May 31, and the ragged regiments of natives, the Spanish detachments, and the companies of deserters from the British—mostly Frenchmen, no doubt—were led into the walled city by the obstinate and invincible Anda, who proceeded to levy the sum of $335,000 from the citizens of Manila to balance the indebtedness contracted for the support of his troops in the field. Anda had manifested some purpose of holding fast to the government when the invaders had been expelled. He had heard that Villacorta, the judge whom the English had sentenced to death, had remarked that he thought the post belonged to him rather than to Anda, whereupon he was placed under arrest. Other judges and prelates were consulted; while most were noncommittal, the provincials of the Jesuits and Franciscans upheld Anda as the only man who could save the situation. The royal order settled the point in 1764, but Anda was regularly installed in power in 1770.

The Augustinian order had suffered more severely from the English occupation than any other corporation: "They plundered and laid waste fifteen of our convents and six estates. Ten of ours died during the war, nineteen were carried off as prisoners, and twelve were banished. They seized our chief

convent at Manila and sold it out, not sparing the flooring or the tiles of the roof, nor the dispensary, library, and lodgings." Thus wrote a survivor of this season of trial. Padre Zúñiga, writing after another generation had passed, finds Anda as cruel to his order as Drake had been. He removed them from their parishes in the country, installing Filipino priests in their place, and their rural convents were almost in ruins before the friars were allowed to return to their charge. Anda retired from a capital full of his enemies and died in obscurity. Later generations have been taught to exalt his memory, but the foreign student can hardly regard him as a skillful warrior or a rational administrator. None of those who celebrate his patriotism have ventured to credit him with modesty or humanity. The notion that he reconquered the islands will not bear examination. When the conference was held at Tambobong in March, 1764, the Spaniards asserted their readiness for recapturing Manila. The British answered by asking why Pasig was left on their hands, though weakly fortified and garrisoned. If such an outpost could not be carried there was little danger in the citadel of *Intramuros*. If Anda failed as a strategist and disciplinarian, he won few laurels as a pacificator.

But the British leaders would gain little by inviting a comparison. Sir William Draper had no trouble in disposing of an improvised defense conducted by irresolute amateurs, but he abandoned his conquest before its administration was organized, and his lifelong pose as a neglected hero was hardly justified by the achievements of forty-eight days in the Philippines. Admiral Cornish staid by his fleet some months longer, but he had no part in the extension of English authority outside the range of his guns. All the responsibility of civil government was left to an agent of the East India Company, to a man trained in the lawless and rapacious methods of the worst period of that company's history.

Governor Drake did nothing to put an end to hostilities even when he knew that peace had been arranged in Europe. He used the forms of justice as interpreted by courts of his own creation to extort money and plate from an impoverished population. To descend to a concrete instance, when leaving the palace whence he had ruled his province he stripped the rooms of "sconces, lustres, lace hangings, and velvet curtains," all of

which were boxed, marked "Rice for Governor Drake," and taken on board the ship which conveyed him to India. Thus reads the statement of Captain Backhouse, who was in command of the garrison until the governor charged him with mutiny, and had him arrested by a squad of soldiers with fixed bayonets, led by a subaltern who appears to have taken a bribe from the governor. Drake quarrelled with officers of both services up to the moment of evacuation, and then made an undignified exit with a shipload of plunder.

The material condition of the capital when it was restored to the Spaniards was doubtless on a par with its moral status. The British removed some of their Chinese coolies and other camp-followers of both sexes, thus diminishing the danger of famine. Certain persons charged with treason to Spain because they had served the English were also allowed to embark. All the Spanish reports are full of charges against Fallet, a Swiss resident of Manila, and Orendain, a *mestizo* doctor of laws. Both had led the natives in unsuccessful sorties during the siege. Otherwise, there is no genuine evidence of disloyalty, unless Spanish suspicion be regarded as evidence. Industrial organization and commercial activity could not be improvised when hostilities terminated. Both sides had confiscated too much property and levied too many ransoms since 1762. The walled city had suffered bombardment, some 5000 shells and 20,000 solid shot having been fired by the English, though the damage was not proportionate to the weight of metal. The suburbs and all towns within the radius of action of the invader had suffered from fire and pillage. The native subjects of Spanish rule had been stirred up by the passions of civil war, and they were left without the shadow of legal protection when the aliens withdrew.

Before attempting any critical interpretation of this episode, another enterprise may be briefly noticed. The Sultan of Sulu (Jolo) had some relations with the English during their occupation of Manila where he was forced to reside, and he was persuaded to grant them the island of Balabac (Balam-bangan) for military and naval uses. The Spanish authorities were inclined to protest on the ground of their vague claim to the sovereignty of the Suluan Archipelago—Borneo was also claimed by a similar title. The chiefs and corsairs of Sulu were divided

into three parties, one favorable to Spain, one ready for alliance with the English, and the third—and doubtless the largest—disposed to sell themselves to the winning power. Finding Balabac "sterile, with a bad climate and worse water," the English had tried to exchange that island for a station near Sulu—in spite of the excellent position of Balabac and the advice of strategic cartographers. A considerable garrison and some colonists were sent from India, and the island doubtless had a larger population in 1775 than it has ever had since.

Since Spain was not ready to expel the English by force, a campaign of intrigue was begun. The English offered a better trade, and were indifferent in matters of religion. On the other hand, the Sultan and his son had lived among the Spaniards and found them more affable and flexible than the English. The decisive influence, however, was based upon practical and piratical considerations. An English naval station would check the favorite pursuit of the *Moros* far more effectually than the Spanish flotillas had ever done, and this peril had to be averted. Besides, it was known that large quantities of Indian goods were stored at Balabac.

A Suluan *dato* named Teteng, after leaving home on account of gambling debts, had settled at Balabac with his slaves and retainers under a contract to cut timber. Finding himself unable to quit the island without leaving his slaves as hostages, Teteng denounced the British governor, who had him thrust into the stocks—a serious matter for a *Moro* chief. Abandoning his slaves, the malcontent went to Jolo to recruit a mixed company to seek revenge and pillage. With runaway slaves and unemployed pirates to the number of 300 an expedition was organized at an island not far from the English settlement. The English had fortified the harbor by two batteries connected by a covered way, but had no guns commanding the landward approaches. The original garrison of 400, made up of Sepoys and English soldiers, had been reduced by climatic diseases until only seventy-five infantry and twenty-eight artillery were available.

Teteng and his pirates hid in the jungle and attacked the batteries in rear at daylight on the morning of March 5, 1775. The garrison had grown negligent, had been celebrating some sort of a holiday; "strong liquors (*el ron y la ginebra*) always

bear a part in what happens to this people," notes a sober Spaniard. With their barracks in flames the garrison was cut off without resistance, the *Moros* losing only two men, and the governor fled to a brigantine in the port. He had to make sail without rescuing any who had lingered ashore. A second brigantine was fired upon and captured by the pirates before she could escape.

The news caused much excitement and some alarm in Sulu. Teteng was outlawed by a decree of the council, but the arrival of the victor on March 23 reversed the action of the court. The sight of the plunder overwhelmed all scruples; cloth of all varieties, silks and cotton, chests of opium, iron and steel from Europe, diamonds, ingots of gold, and $14,000 in silver coin were exhibited. Moreover, there were 45 cannon, 228 muskets, other small arms, and a vast store of ammunition, and all this went to the sultan. A man who could acquire such riches and share the spoil with generosity was bound to be well received anywhere, "especially among Suluans," says our chronicler. Even the slaves got something, and the whole nation was bound together in enmity of the English.

English journals for 1776 heard of the loss of Balam-bangan —which was sometimes confounded with Bombay—but such an island hardly counted in that fatal year. The goods carried off by the *Moros* had cost $946,000, and the projected pearl-fisheries had to be abandoned. And Lord Pigot, appointed to govern the new colony, sailed too late to find it garrisoned. The Spanish congratulated the sultan over his gains, and there was some dealing in prize goods at their town of Zamboanga. But the arrogance of victory led to activity in the national pursuit, and the Suluans continued their depredations on the coasts of Luzon for another century. The Spaniards finally established a naval station on Balabac, and there was some talk of trade coming that way. The expectation was not realized, though the station was maintained up to 1898.

A brief account of more primitive plans for securing British influence in the Philippines may be of interest. In 1588 Cavendish, after taking the Manila galleon near Cape San Lucas—the wrong galleon, since he had to burn most of her rich cargo of China silks, though he saved satins and brocades for a suit of

sails to carry him into an English port—anchored at the island of Capul in the Strait of San Bernardino, where he hung his Portuguese pilot and made friends with the natives. Hakluyt's Voyages record that, "On the 23d day of January, our General, M. Thomas Cavendish, caused all the principals of this island and of an hundred islands more, which he had made to pay tribute unto him (which tribute was in hogs, hens, potatoes, and cocos) to appear before him, and made himself and his company known unto them, that they were Englishmen, and enemies to the Spaniards: and thereupon spread his ensign and sounded up the drums, which they much marvelled at: to conclude they promised both themselves and all the islands thereabout to aid him whensoever he should come again to overcome the Spaniards. Also our General gave them, in token that we were enemies to the Spaniards, money back again for all the tribute which they had paid: which they took marvellous friendly, and rowed about our ship to show us pleasure marvellous swiftly: at the last our General caused a saker to be shot off, whereat they wondered, and with great contentment took their leaves of us." This genial performance was quite as effective as the Spanish trick of annexing islands by proclamation.

Dampier, the scholarly buccaneer of the next century, lingered on the coast of Mindanao for some months in 1686, and would have induced his shipmates to accept proposals made by the *Moros* had he held any authority among them: "Indeed upon mature thoughts, I should think we could not have done better than to have complied with the desire they seemed to have of our settling here, and to have taken up our quarters with them. For as thereby we might better have consulted our own profit and satisfaction than by the other loose roving way of life, so it might probably have proved of public benefit to our nation, and been a means of introducing an *English* settlement and trade, not only here, but through several of the Spice Islands, which lie in its neighborhood." "We had also a great advantage above raw men that are sent out of England into these places, who proceed usually too cautiously, coldly, and formally to compass any considerable design, which experience teaches better than any rules whatsoever; besides the danger of their lives in so great and sudden a change of air; whereas we

were all inured to hot climates, hardened by many fatigues, and, in general, daring men, and such as would not be easily baffled. To add one thing more, our men were almost tired and began to desire a *quictus est;* and therefore they would gladly have seated themselves anywhere. We had a good ship too, and enough of us (besides what might have been spared to manage our new settlement) to bring the news with the effects to the owners in England." They had come to Mindanao hoping "to get a commission from the Prince of the island to plunder the Spanish ships about Manila, and so to make Mindanao the common rendezvous." The conquerors of 1762 had much the same aspirations.

In attempting to criticise such enterprises as the English attacks on the Philippines it is useless to distinguish too sharply between their moral aspect and their practical result. If they brought ruin and waste along with them, they must be classed among the failures, if not among the scandals, of history. But it cannot be asserted that the purpose of these undertakings was high, or that they were executed in rational and humane fashion. Sir William Draper formulated his principles of conquest by claiming that places carried by storm were subject to whatever the conqueror chose to inflict: "Manila was in this horrid situation, the lives of the inhabitants, with all belonging to them, were entirely at our mercy." Considering the situation in this light, Draper was, like Clive, "astonished at his own moderation." He admits slackness in the discipline of his troops, "a motley composition of seamen, soldiers, sepoys, cafres, lascars, topases, and French and German deserters." But the ransom of $4,000,000 was nothing to what might have been gained by systematic pillage, and casual irregularities on the part of the invader could not be alleged to justify repudiation.

Whether Draper's instructions contemplated annexation or not, it appears that the cooperation of disaffected natives was counted upon. To organize the revolutionary impulse thus to be inaugurated there was the paltry and motley garrison in the hands of the predatory Mr. Drake and his fellow-servants of the East India Company. The story of Spanish weakness and its origin in misgovernment was not unknown to those who planned the expedition. What institutions, laws, and administra-

tive reforms were inaugurated by Great Britain? Except for vague professions of benevolent intentions in regard to taxes and forced labor, there was no manifestation calculated to win the natives to accept a new order and an intrusive civilization. Nor does there appear to have been any sense of responsibility for the sequels of alliance with insurgent natives or mercenary Chinese.

Of the defects of the Spanish system of domination, defects which led to the collapse of every moral and military element of defense at the first shock of foreign invasion, this is no place to speak. The narrative written by the Marqués de Ayerbe in 1897 notes these errors and warns his countrymen against the results of persistence in a mistaken policy. He reminds them that "The English employed the native element in that very province of Cavite, which we have just had to reconquer foot by foot." He notes the unpopularity and inadequacy of theocratic government in seasons of peril, and the lack of force to maintain Spanish authority in remote colonies. Yet he still had faith in reforms, and by no means counselled abandonment.

The strategic lessons of our subject are sufficiently obvious. No nation can maintain a sound colonial system beyond the radius of her maritime supremacy; yet the Spanish claim to dominate the shores of the Pacific was never supported by the concrete reality of sea-power. Next to superiority in naval strength comes the maintenance of communication between the mother country and her possessions, or between the belligerent government and its agents abroad. Both Spain and England failed in organizing the transmission of intelligence, and their commanders in the Philippines were left to sin or suffer in ignorance. The miserable incidents which result from the despatch of an army of invasion made up of heterogeneous and undisciplined elements are no less apparent than those attending the effort to wage defensive warfare among a disaffected population. Of the tactical lessons of the campaign even less can be said. The rules of eighteenth century warfare were not observed on account of the demoralization of the defense. Nor was there much opportunity for the development of tactical skill in the punitive and foraging expeditions sent out from Manila. The mortality among the invaders does not seem to have been large, but we have no figures that will bear discus-

sion. The British garrison was too small to show a great numerical loss—the Spanish claim that it amounted to 1000—but guerrilla warfare and defective sanitation doubtless claimed their percentage. But history is concerned with the results of conquest rather than with the incidental expenditures.

Authorities Consulted.

ENGLISH.

Annual Register, 1763 and 1764.—These volumes were edited by Edmund Burke, and they contain a sketch of contemporary history based on current discussion and documents. Burke has been censured by Crawfurd (*Dictionary of the East Indian Islands*) for presenting too favorable views of the conduct of Sir William Draper in his account of the Manila expedition. It is to be regretted that the situation during the period of British occupation was not discussed more fully.

Dictionary of National Biography.—The first step in studying any period of English history is to read the life of someone connected therewith in this masterly work—the only systematic and complete work of reference in the English language available for the general reader. Unfortunately, the notice of Sir William Draper falls below the usual standard of the series and is not to be compared with the naval biographies prepared by Professor Laughton, which now reveal the true naval history of Great Britain after generations of darkness. No references are given to the *London Gazette* or the *Annual Register*. A false reference is given to the *Reports of the Historical MSS. Commission*, which do not print the original instructions given to Draper. I have been unable to consult Beatson's *Naval and Military Memoirs*, but references to the *Calendar of State Papers, Home Office*, 1760-5, and to *Horace Walpole's Letters* have been found interesting.

History of England in the Eighteenth Century, W. H. E. Lecky.—The political and diplomatic affairs of the period are clearly set forth and fairly discussed in these volumes.

Frederick the Great, Thomas Carlyle.—The graphic notes and summaries of general history often furnish the best illustrations of the period.

SPANISH.

Historia de las Islas Filipinas, Padre Fray Joaquín Martinez de Zúñiga, Sampaloc (Manila), 1803.—The English translation of this work by Mavers has been used, though it appears to be an imperfect rendering of the original. This seems the best general history of the first two centuries of Spanish domination.

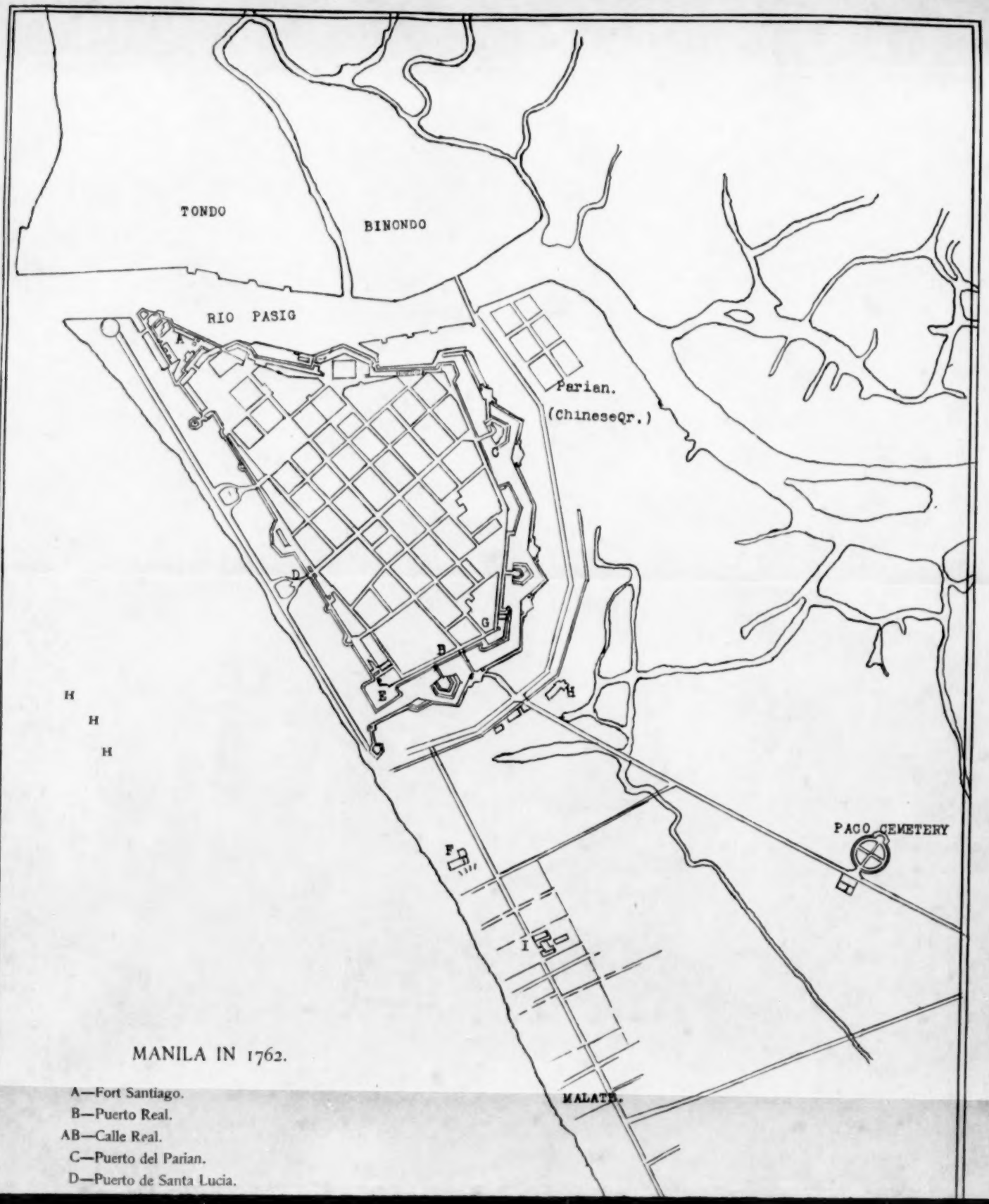
Sitio y Conquista de Manila por los Ingleses en 1762, Marqués de Ayerbe, Zaragoza, 1897.—The introduction is rather artless in its handling of authorities, Goldsmith's *History of England* being cited, for example. Zúñiga's history and one written by the Dominican Fathers have been consulted, but the chief value of this pamphlet of 135 pages is derived from an unpublished MS. by Don Rodríguez de Ovalle. This officer was sent out with despatches and made the voyage from Acapulco to Manila in 83 days, arriving March 15, 1764. He then set to work to collect authentic details covering the events of the last two years. He seems to have been a fair critic of military affairs and not an adept in the art of wholesale vindication. His narrative should have been printed at length.

Relacion de los Alzamientos de la Ciudad de Vigan, Padre Pedro del Vivar, Religioso Agustina, 1764 (*Biblioteca Historica Filipina*, vol. iv, Manila, 1893).—This gives an account of the insurrection led by Silán in 1762-3.

Guerras Piráticas de Filipinas, Don Vicente Barrantes, Madrid, 1878.—This book is principally based upon an anonymous document, which chronicles various phases of the struggle with the *Moro* pirates up to the beginning of the nineteenth century. It describes the expulsion of the English from Balabac.

Memoria acerca de las Misiones de los PP. Agustinos Calzados en las Islas Filipinas, Madrid, 1892.—This notes the losses of the Augustinian order during the British occupation.

Historia de España, Don Modesto Lafuente.—An excellent general history of Spain.

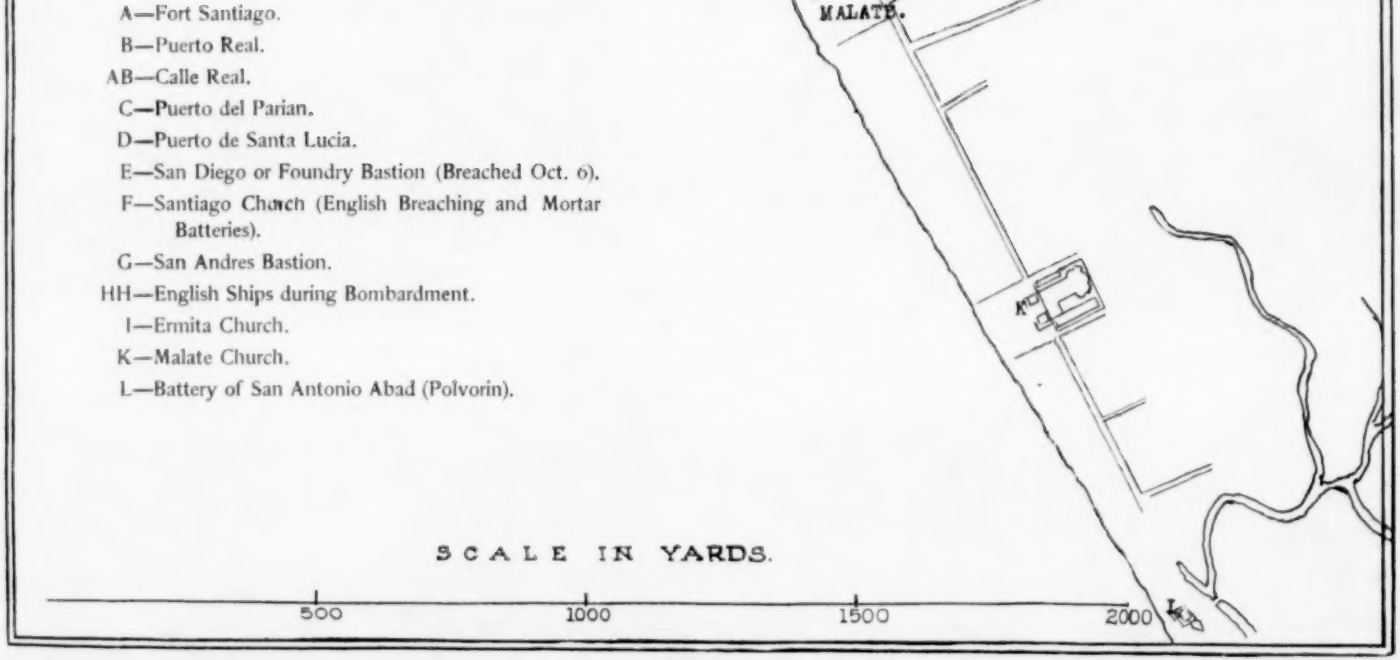


MANILA IN 1762.

A—Fort Santiago.
B—Puerto Real.
AB—Calle Real.
C—Puerto del Parian.
D—Puerto de Santa Lucia.

MANILA IN 1762.

A—Fort Santiago.
B—Puerto Real.
AB—Calle Real.


A—Fort Santiago.
B—Puerto Real.
AB—Calle Real.
C—Puerto del Parian.
D—Puerto de Santa Lucia.
E—San Diego or Foundry Bastion (Breached Oct. 6).
F—Santiago Church (English Breaching and Mortar Batteries).
G—San Andres Bastion.
HH—English Ships during Bombardment.
I—Ermita Church.
K—Malate Church.
L—Battery of San Antonio Abad (Polvorin).
MALATE.
SCALE IN YARDS.
500
1000
1500
2000

DISCUSSION.

"OUR NEW BATTLESHIPS AND ARMORED CRUISERS." See No. 96.

Rear Admiral R. D. EVANS, U. S. N.—The questions propounded by Naval Constructor Taylor are the most serious and important ever put to the sea-going officers of our service, and we owe him not only our thanks for asking them, but our earnest professional opinion in answering them.

For me, the answer is an easy one. I say unhesitatingly that we are making a serious blunder in building ships so much alike as the battleship Virginia and the armored cruiser Maryland, and the sooner we stop the practice and get back to sound military principles the better it will be for us when battle shall give us the only real test.

In the days of wooden ships our superiority was entirely owing to the heavier batteries we carried, and when we became the builders of steel battleships our first efforts were splendidly successful because we stuck to the same principle. I say battleships, but it was equally true of all classes. In our cruisers we added also the quality of speed, because we recognized the fact that speed to a certain extent was the controlling factor in the vessel intended for scouting work and not intended for the line of battle.

Gradually a change came, and somebody with sufficient influence to dominate the Navy Department began to undo the good work of our constructors, until to-day we find thin armor and light guns the rule in our projected ships of the line of battle.

I am surprised that Mr. Taylor does not see the cause of all this, or does not, if he sees it, come out squarely and condemn it and suggest the remedy. To my mind the craze after speed in a battleship is at the bottom of it all. The desire for a thing that is absolutely of no value after you get it has compelled the thinning of the armor and the reduction in caliber of guns, two of the vital things in battleship construction. In order to obtain 19, or, worse still, 21 knots' speed, we must sacrifice the things that make a battleship, and having attained this speed on the trial trip, we can never hope to reach it again because we can never realize the same conditions in actual service. In other words, we must carry around during the entire life of the ship a lot of dead weight in the shape of machinery which should have been put on the outside in armor, and in the battery in armor-piercing guns. Cut the speed of our battleships down to sixteen knots sea speed, and then on a displacement of 15,000 tons give us all the protection you can, and a steaming radius as great as possible.

Battleships are not intended to do the work of cruisers; they are intended to fight, and for that purpose alone they are built. If others choose to thin their armor in order to get speed let them do it, and when the day of battle comes they can run away or get whipped just as they prefer; they amount to the same thing when you consider the ob-

jects of a naval campaign. Make the distinction between the battleship and the cruiser clear and distinct. Heavy armor, heavy guns, and moderate speed, with great manœuvering qualities, the features of one; great speed and coal endurance the features of the other, with as much armor and battery as possible; but above all things stick to the moderate speed for the battleship, because it is the attempt to get away from it that makes of her an indifferent armored cruiser.

The craze for rapid fire in armor-piercing guns has had its share also in the retrograde movement in our later battleships. I do not for a moment doubt or discount the value of rapid fire up to a certain point, but beyond that point it has absolutely no value and will only deafen men and overheat the guns. A well-sustained, accurate fire of moderate rapidity will win over the unevenly sustained and inaccurate fire that must follow the effort to fire with the greatest possible rapidity.

It would have been only reasonable to expect that, as armor was made more perfect and more difficult to penetrate, we would find more armor-piercing guns in our new ships, but such is not the case. On the contrary, we find the 12-inch instead of the 13-inch, and the number of 8-inch reduced, as in the case of the Alabama and Illinois, in favor of the rapid-fire 6-inch, a purely cruiser gun, in my opinion, and one that certainly cannot pierce the armor now being generally put on foreign battleships outside torpedo range.

In conclusion, let us come back to the sound principles as shown in our first battleship—a few more guns and a little more armor than others have. Let our constructors bend their minds and energies to giving us a ship of about 15,000 tons with armor protection for the entire ship; speed sixteen knots sustained at sea, and the following battery as near as may be:

Four 13-inch guns, *in turrets*, forward and aft.

Twelve 8-inch guns in broadside, with sufficient splinter protection but *no turrets*. Four of these guns to be capable of firing directly ahead and four astern, and all so arranged that they may be worked entirely by hand in case of necessity.

Twenty-five to thirty 50-caliber 14-pounders, and such smaller guns for torpedo defense as can be properly installed.

We can have such a ship, I am sure, if we are willing to take her with a speed of sixteen knots.

Lieutenant-Commander J. B. MURDOCK, U. S. N.—The very pertinent questions with which Mr. Taylor closes his article open up the whole question of armored ships. The status of the battleship is becoming fixed. Naval opinion the world over seems to be settling towards the adoption of the twelve-inch gun as the maximum caliber. These are supported by a broadside battery of six-inch, generally in a casemate. After building several ships of this type, we have reverted to the eight-inch gun in turrets in addition to the two other calibers. I think this change as outlined in the new battleships is most satisfactory to the service. The eight-inch has always been a favorite in our navy, and

since the Spanish war is more of one than ever. The battery design of the Virginia is formidable, and the ship, from our point of view, is fully able to carry her guns. The type to me seems most satisfactory, not excelled, in fact, by any afloat.

The armored cruiser is more the result of compromise between conflicting conditions than any other class of ship, and as a result there are numberless very different types in existence in different navies. Standard there is none, but it is all essential that the vessels designed for any navy should be adapted to its necessities. In our methods of construction we are more in touch with the British than with any other nation, and many of our ships, the Maryland perhaps among others, have been designed as improvements on British types. This is wise or not, just as the needs of our service may agree with or differ from those of the British navy, and it is as well that we should study the whole world of naval construction. Thus the Italian built Colon has been greatly admired in our service as an admirable type of armored cruiser, combining apparently all necessary qualities on very small displacement.

In 1898 Great Britain laid down ten armored cruisers of a size and speed greatly superior to any existing. There were six of the Cressy Class of about 12,000 tons and four of the Drake class of 14,000. The two types were designed for 21 and 23 knots respectively, and their evolution is largely due to the construction of fast French armored cruisers built as commerce-destroyers. British trade has already been a favorite object of French naval attack, and if war should ever arise between the two powers, the ancient practice of commerce-destroying would be again brought forward under the fancy that it was war.

If France builds men-of-war for any such purpose, the possibilities arising therefrom must of course be considered by the Admiralty. Hence the cruisers of 1898.

It does not seem to me to be sound policy for us to follow any other nation in our construction. While it may be a source of gratification to our designers to improve on a type which is recognized by everyone as very good, or to the nation at large to know that it possesses the biggest or fastest man-of-war afloat, it is unquestionable that these laudable ambitions may load our navy list with freaks and frauds—ships absolutely lacking in naval efficiency. Let us rather study our necessities and act accordingly. First and foremost are the demands liable to be made on the navy by the country. Apart from the vital importance of keeping an enemy away from our coast, we are entering as a world power on complications undreamed of ten years ago, and the possibility of hostilities in any or all parts of the world shows that the work of the navy will be arduous if war should arise with any first-class power. The loss of the command of the sea may involve the loss of any of our outlying possessions, and communication can be kept up only by having a powerful naval force at any and every threatened point. The best of officers can do nothing without ships, and he must have not only enough, but they must be of the right kind as well.

If we glance over the world, examining the numerous places at which we may come in contact with other naval powers, and then analyze each case, we will find everywhere the demands are practically the same. We will need, when war comes, good honest fighting ships—ships that not only show the flag, but can uphold it in a general fleet action. Auxiliaries, scouts, cruisers, torpedo-boat destroyers and torpedo-boats will all have their places, but no one, nor all together, can decide a naval campaign. That must be done by the fighting ship par excellence. As we have no commerce to protect and have outgrown the aberration which induced us to build the Columbia and Minneapolis, we have no call to build any vessel for patrolling our trade routes or attacking an enemy's.

To my mind, this is so clear that any armored vessel built for our navy appears as useless if she is not a fighting vessel. Instead of armored cruiser, I prefer to use the term "battle cruiser," to represent a vessel having the speed of a cruiser, but yet so designed as to be able to take a place in the line of battle in a fleet action and give a good account of herself. She must have speed, and by providing small vessels of this class—fast second-class battleships if you will—an unwilling enemy could be chased, harassed and very probably detained until he could be brought to action. A "battle cruiser" of this type would have a greatly increased radius of action over the heavy battleship, and could do a thousand things much better. The work of the New York in the Spanish war is a justification to us for the "battle cruiser" beyond any argument.

If this reasoning is correct, our "battle cruiser" must possess the following main qualifications: First, speed, at present set at 22 knots; second, sufficient gun power to be able to give heavy blows against battleships in action, and third, enough armored protection to give the ship a chance for life even when opposed to much more powerful foes. Small guns and thin armor must be shunned, as unfitting the ship for actual battle. As in the old days, 90- and 74-gun ships fought in the same battle-line, so to-day there is nothing inconceivable in having battleships and "battle cruisers" similarly associated, provided *the latter are built for the purpose.* I see no reason why we should not adopt the rule that every ship on which armor is placed should be designed to fight in company with battleships, and am sure that in this way we can secure the best return to the nation for its money. Can we afford to spend millions on a ship that cannot fight?

With these general ideas in my mind, I am not enamored with the Maryland type. They are powerful vessels and possess great offensive and defensive strength, but not to my mind as much as they should, or as much as could be given them. A solid citadel of five-inch Krupp steel covering all gun positions is admirable, and is much stronger than that possessed by most battleships now in service for their broadside battery. The Maryland, however, is not only liable to meet ships now in commission but others building, as well as many not yet laid down, and her design should have every possible improvement to forestall, as

far as may be, future advances in construction and ordnance. Now, as a fact, we find that the Italians and Japanese are designing their latest vessels with six-inch plates. A still worse feature of contemporary foreign design is the fact that other nations are using heavier guns behind their thicker armor. The Maryland's six-inch guns are powerful weapons, but are weak against the six-inch armor we find on foreign ships, while their eight- or nine-inch guns would penetrate hers with comparative ease. A ship must not be not only inherently good, but must rank high among her contemporaries.

In order to fairly test the Maryland, let us compare her directly with ships either existing or laid down. Many of the former have Harvey steel instead of Krupp, and, in the comparisons made, will be credited with Krupp in order to bring them up to the same date as the Maryland. The data given in the report of the Chief of Bureau of Ordnance for 1899 will be used as a basis. He gives the following perforations of Krupp armor in inches by our latest type of guns:

	At 1000 yards.	At 2000 yards.	At 3000 yards.
8-inch, Mark V	10.44	9.34	8.25
6- " " VI	7.28	6.14	5.3

One of the best of recent ships is the Asama of the Japanese navy. Giving her the Krupp armor that is actually going on later ships of her class, we find that she has the same speed and armament as the Maryland, while her gun positions are protected by six-inch armor instead of five. Four six-inch guns are without armor, and her battery power is thus brought below that of the Maryland. At 3000 yards, however, she has fourteen protected guns that could penetrate the latter's armor, while her own armor is liable to injury only from the four eight-inch guns of the Maryland. It is difficult to avoid the conclusion that the Asama is the better fighting ship, yet she is of 4000 tons less displacement and probably cost a million dollars less.

In comparison with the latest German cruiser, the Prinz Heinrich, there is some uncertainty as to whether the six-inch guns of the latter have four- or six-inch armor. Assuming the latter to be the case, we find the same state of affairs existing as with the Asama. At 3000 yards the German has twelve guns that can pierce his adversary's armor as against four of the latter that can injure him. As the Maryland has the advantage of a knot and a half speed, she could close to a range where her battery would become effective, but as her great length makes her unhandy in manœuvering as compared with her adversary, the latter might succeed in torpedoing her. In this case the issue between the two ships is by no means certain, but the Maryland is 4500 tons the largest and cost at least a million dollars more.

Coming to ships still on paper, we find the Amalfi class in Italy. The scheme of development of this class is to obtain 22 knots, with six-inch armor protection and eight-inch guns on moderate displacement. There is some doubt as to the exact form the type will finally develop, but let us assume that given in the Naval Intelligence Annual for 1900,

as it is not impossible. Here we find our adversary as having the same speed as the Maryland and with a battery of twelve eight-inch guns, capable of piercing all her armor at any practical fighting range, while our ship can use only four guns with any effect beyond 2000 yards. To accomplish anything it will be necessary to close, but our smaller and equally fast antagonist can easily out-manœuver us and choose his own position. As before, we find the Maryland struggling unsuccessfully with a smaller antagonist.

The British Drake and Cressy classes have light armor over their six-inch guns, but carry two 9.2 guns apiece. The former is probably more powerful than the Maryland as having a knot more speed. It is noticeable that both of them have been criticised in Great Britain as lacking fighting power.

It may be gratifying to know that our new type of cruisers could probably defeat the New York and Brooklyn at once, but they are not of her date. What we should seek is the greatest *fighting efficiency* (this includes speed and handiness, as well as battery and armor) on a given displacement. Has this problem been solved in the Maryland? Let us take her sister ship, the Colorado, and modify her as follows: Shorten the citadel about one-fourth so as to allow it to have six inches of armor throughout. Remove two of the six-inch guns on the gun deck. Replace the four six-inch guns on the main deck by eight-inch and give them six inches of armor protection; change nothing else. We have slightly increased the weight but imperceptibly, and the two ships would have the same speed. We have now:

	Maryland.	Colorado.
Speed, displacement, stores, armor belt, etc.....	The same in both.	
Battery	4 8-inch.	8 8-inch.
	14 6-inch.	8 6-inch.
Armor over 8-inch guns.....	6½	6½
Armor over 6-inch guns.....	5	6

The Colorado, by keeping outside 2000 yards, would have comparative immunity from the Maryland's six-inch guns, while all of her own would be effective against the latter's citadel up to 3000. I think this Colorado by far the better ship of the two, and strong enough to meet foreign ships.

To come down to Mr. Taylor's questions. I would not build any more Marylands at all. Powerful as they are, they are too cumbersome for manœuvering, and not strong enough either offensively or defensively for the line of battle. They would, moreover, be a nuisance in a squadron from their clumsiness. Recognizing their unquestionably good points as I do, they do not seem to conform to the requirements of our service for practical fighting ships.

I believe that our latest type battleships are fast enough and big enough to answer all demands. There is, as already stated, an ever-existent demand to build something bigger, and, hence, more powerful

than anything in existence, and although the British Admiralty is conservative in its policy of construction, we read of its laying down 18,000-ton battleships. Let us resist the temptation to improve on this type. We are getting a long distance away from the idea of handiness, and yet good manœuvering power is one of the essentials in a fleet action, as important perhaps as speed. In the long naval wars of the Napoleonic era, Great Britain left big ships to her adversaries, and did most of her fighting with her 74's. This class won at the Nile, St. Vincent and Trafalgar, and British officers of the day laughed at the unwieldiness of the Santissima Trinidad, Orient and other leviathans. Is there not a lesson here for us to bear in mind?

Although outside the discussion proposed by Mr. Taylor, it is noticeable that every criticism I have suggested against the Maryland class applies with still more force to the St. Louis. The latter has four-inch armor and no gun larger than a six-inch. It is no argument, however true it may be, to say that the new six-inch is as powerful as the old eight-inch. We should not arm our new ships to compete with old types, but ought to make them fit adversaries for any of their date and displacement in the world. The St. Louis would have a poor chance in a combat with the Asama or Amalfi of the same size, as they could riddle her at a range of 3000 yards, while their own armor would defy her six-inch guns. It would be almost like fighting a wooden ship against an armor-clad. I believe that the St. Louis could be easily modified on her present displacement to carry eight eight-inch and four six-inch all behind six-inch armor. Would she not be a vastly more efficient ship for our navy? Under this construction she could take her place in the line of battle and penetrate the casemates of any existing battleship at ranges up to 5000 yards, or the turrets of half of them at 2000. To be sure she might suffer herself, but it would take the main battery, twelve- or thirteen-inch guns, of any but the most recent battleships, to do her serious injury.

My answer to Mr. Taylor's questions is, therefore, a compromise. I would build nothing larger or faster than the Virginia, but would develop a smaller and handy battle cruiser of about 9500 tons. If the money for eight Virginias were put at my disposition, I believe the demands of our national policy would be better met at present by five Virginias and five St. Louis, modified as above. This would give us ten fighting ships, every one available for battle, and five as well adapted for ordinary service as the New York and Brooklyn have shown themselves to be.

Mr. Taylor would call this a revision to an old type, but it is, I believe, the true policy for us to follow.

Captain CASPAR F. GOODRICH, U. S. N.—In my judgment, no more important article than this has ever been published in the PROCEEDINGS OF THE NAVAL INSTITUTE. I have but one regret in connection with it —that it was not written and printed several years ago. That it will prove epoch-making I have no hesitation in predicting.

My answers to the questions with which Mr. Taylor concludes his interesting and instructive exhibit of facts are as follows:

To the first, emphatically, "No; we are *not* warranted in continuing to build at the same [or any] time vessels of so nearly the same size and cost, and differing so widely in other respects, as the Maryland and Virginia."

To the second, emphatically, "No; it is neither consistent nor logical to increase again the speed of our battleships to, say, 21 knots."

To the alternate form of his question I answer emphatically that it would not be well to build either four Virginias and five Marylands, or eight Virginias or seven Virginias of 21 knots' trial speed. "Of two evils, choose—*neither*"—so spoke a wise old lady of Puritan stock.

Let us endeavor to put the case on a war footing. Admiral Blank commands our fleet, with which he has to meet the powerful squadrons of our adversary, the Emperor of the Antipodes. He is given by the conventional fairy the fulfilment of a wish. He may call for such ships, in type and number, as he thinks best suited to his wants, provided, however, they do not cost more in the aggregate than the amounts allotted for shipbuilding in the annual appropriations of the past few years. What form will his wish take. How will he ask that these vast sums had been spent? Having this superhuman power, will he create such a fleet as we have been preparing for him? If we can guess these riddles, we shall be in a position to reply intelligently to Mr. Taylor's queries.

In the Maine class, the displacement of our battleships took on a notable increase, and this growth has steadily continued in later designs, while the armored cruisers have jumped from the Brooklyn's 9200 tons to the astonishing figure of 14,000 tons in the Maryland. Admiral Blank, knowing these things, does a little mental arithmetic, which shows him that by keeping to the dimensions of the Iowa, for example, he would have saved on the five classes of armored vessels represented by the Maine, Georgia, Virginia, California and Maryland, no less than 35,740 tons, enough to add three Illinois to his command. He would, moreover, have a homogeneous fleet composed of units practically identical in dimensions, in battery power and battery distribution (even with the widest latitude for variations in details) and, most important of all, absolutely identical in tactical qualities. By the plan we have followed, Admiral Blank has lost three good ships, carrying 54 or more guns in their main batteries. And what has he gained in their stead? A knot or two more speed in the later vessels and some hermaphrodite affairs, called armored cruisers, for which he can find no place in his line of battle, and this at a time when he needs all the fighting craft available and more too. If Admiral Blank is a good American, he has surely studied Captain Mahan's essays, and he has read that numbers are needed to crush—numbers of ships, numbers of guns, numbers of men. He will find nowhere in the writings of that eminent authority any suggestion that especially high speed is essential in a battleship. What is decided by speed is a race—not a fight. If

fleet A is stronger than fleet B, the latter gets behind forts and barricades the harbor entrance. If it is caught outside by fleet A, I grant, cheerfully, that it will rejoice in the advantage of an extra knot or two on its part, but as I understand the matter, battleships were constructed for a very different purpose—to meet, not to run away from, the enemy. When they seek refuge in flight they confess defeat.

I grant, also, the value of high speed in strategical movements, but of what earthly use is it to make the tremendous sacrifices which we have, unquestionably, made in numbers of ships and in equality of tactical features in order to gain a couple of knots for certain individual members of the fleet, when, as is axiomatic, the squadron's rate is that of the slowest, not the fastest ship?

No one doubts for a second the intrinsic merits of the more recent additions to our list of battleships. If they were destined to roam the seas each on its own account, then would it be well, perhaps, to secure greater speed, greater powers of offence, greater protection, greater coal endurance, without regard to harmony of action, but the case with which Admiral Blank has to deal is a very different affair indeed. It is the last expression of our most serious needs; our existence as a nation may lie trembling in the balance. After but little deliberation, he says: "The speed of the Oregon at Santiago is speed enough for me. I wish the money appropriated for armored ships to have been expended on battleships, all reasonably similar in design and having the speed and tactical qualities of the Iowa, that I may have three additional ships with which to meet the enemy, even if none of them can steam over seventeen knots."

If the Emperor of the Antipodes means business, Admiral Blank can not have too many guns with which to receive him. If he does not mean business, then superior speed will not avail to force an action. I have always been of the opinion that we can pay too dearly for that extra knot or so. Trial trip reports, with their glowing accounts of a fraction of a knot achieved over previous records, may appeal to the public ear, but they can not possibly have great weight with the tactician who reads, between the lines, that a new type or pattern of ship has been added to our already bewildering multiplicity. No one, I hold, has any right to entertain or express an opinion on types of fighting ships who has not carefully studied the chapter in Colomb's Naval Warfare, which treats of the gradual development of the 74-gun ship as the rational outcome of a century's warfare and a century's search for what, taking all things into consideration, was the best unit in the line of battle.

May a strong believer in the torpedo be permitted to suggest that the times are ripe for omitting that weapon from the armament of a battleship? Keep the item, 4 torpedo-tubes, on the navy list, but calmly leave the things themselves on shore and don't burden the line-of-battleship with their heavy and useless fittings.

Mr. Taylor pertinently asks, why build more armored cruisers? Rather, I say, why have built any at all? The first two, the New York and the Brooklyn, were laid down, I fancy, simply because similar ships ap-

peared in certain European navies; so, of course, we must have them too. The logic is very clear, it will be perceived, and it has proved convincing, but a defender of the type on purely tactical grounds has never, so far as I know, stepped into the arena to champion their cause. I wish he had. In 1895, in a lecture at the Naval War College, I used these words:

"Of the armored cruiser, I confess, with deep regret, my inability to treat. I can find no logical place for her in the fleet. She is less than a battleship and more than a cruiser. She is a compromise, with all the disadvantages which compromises present. Her speed is immense, true, but that follows from her displacement and horse-power, not from her military features which are largely sacrificed to speed."

No tactical study of the type has come to my notice, and nothing has happened since the time those words were written to remove my grave doubts as to the merits of the armored cruiser.

If anything at all was demonstrated beyond peradventure at Santiago, it was the helpless, hopeless inferiority of the armored cruiser to the battleship, yet six more of the type, all as big as battleships and costing practically as much money, have been designed and contracted for since the treaty of peace with Spain. I can not understand such obstinate clinging to a class discredited in actual warfare, and I regret, beyond measure, the diversion of so much money from the paramount aim of a navy—strength in its line of battle.

Mr. Taylor has done the navy a lasting and a notable service in suggesting that we pull up and do a little thinking before plunging in too deeply. Personally, I am confident that the fear he hints at rather than expresses will be realized, and that we shall all be sorry for having run to an extreme. No one will appreciate this error more than Admiral Blank, for, unhappily, the good fairy of fiction will not appear at the critical moment to rescue him from his embarrassment by turning his job lot of ships, each of which is freely admitted to be admirable in itself, into what alone he needs so urgently—a homogeneous fleet. While Admiral Blank will do the best he can with the tools at hand, he will roundly anathematize those who, having the means and the opportunity, failed to provide him with properly equalized units, and if he thrashes his opponent, as we fondly hope he will, it will be in spite of, rather than on account of, our erratic building programme.

Commander RICHARD WAINWRIGHT, U. S. N.—Naval Constructor Taylor's paper is most valuable from the clear manner in which he has presented the facts. It will prove far more valuable if it aids in settling the types of vessels to be built, according to some tactical rules.

Since the new chief constructor has come into office the fallacy of sheathing battleships has been killed, and we may hope for the burial of "fire-proof" wood. A still greater victory for sound knowledge, both of theory and practice, will be the designing of ships for certain tactical uses within reasonably definite limits.

For many years we have been designing new vessels, each one being

more or less superior to its predecessor of the same type, and this superiority has been largely made possible by increased displacement. Better guns, better armor, better engines and better forms have not been sufficient, but greater displacement has been required. I believe we have reached the limit of size, if we have not passed it. Our future improvements should not be in the line of increased displacement.

I do not believe we would be warranted in continuing to build more Marylands, and I do not believe we would be warranted in building larger Virginias. It is not very difficult to show the strategical and tactical advantages of high speed. To me the need for armored cruisers is as apparent, although the reasons for holding this belief are not so easily pointed out. Nothing is so clear as the strategic advantages of speed. The tactical advantage of being able to force your enemy to fight is also apparent. But there is an additional tactical advantage in superior speed, in fleet actions or in single combat, of being able to concentrate a greater number of guns on a given point than your enemy. In a single ship with greater speed you can present beam fire to your opponent's end fire, and in a fleet you can present beam fire of a number of ships to the end fire of a few of your opponent's ships. Certainly you can make too great a sacrifice for speed. There will be little use in bringing the guns of a greater number of ships to bear on the enemy if it still leaves you with fewer guns and less well defended.

All will admit that it is necessary to have some type of vessel that will bear the same relation to the modern battleship that the frigate did to the old line of battleship. The divergence of opinion arises when an attempt is made to outline the type. I believe that the armored cruiser should take the place of the frigate. Many give this place to the protected cruiser, not the most recent protected cruisers which are armored, but to those protected by armored decks alone. Some will go further than this and use the auxiliary vessel for that purpose, where none of the displacement is sacrificed for protection and very little for armament. These latter are admirably adapted for a portion of the work allotted to a frigate, as they have a very large steaming radius. The objection to both auxiliaries and to protected cruisers is their want of sufficient protection to enable them to run necessary risks with reasonable chance of success. Armored cruisers should have sufficient protection to encounter the fire of one or more battleships at long range, and their own class at short range, with some chance of getting away with the information gained. To be able to close in with an enemy's vessels so as to gain accurate information and to tow a damaged battleship out of action, they should have slightly superior speed to battleships of the same date and a larger steaming radius. An improved Colon, with battery as in the San Martin, particularly if the oil jet for high speed is a success, about fits my idea of an armored cruiser.

While certain individual vessels may prove wonderfully successful in unusual circumstances, the sound general rule for war vessels would be never to build vessels of a type such as must run away from smaller vessels; Marylands to run away from Oregons, or Columbias to run

away from a Texas. The feet of the army are most important to the general, but battles will never be won by showing the enemy your heels. To carry out this rule, protected vessels, if built, should not be above six thousand tons displacement, armored cruisers not above eight thousand; after that, all should be battleships. The more nearly these latter can be made of the same tactical qualities the stronger they will be when grouped together.

Captain Walker, in the September number of the PROCEEDINGS, says, speaking of the modern armored cruiser: "Her rôle in a nation's fleet is assumed to be that of a vessel possessing in a high degree offensive and defensive qualities, with the capacity of delivering her attack at points far distant from her base in the least space of time." The latest armored cruisers do not possess in a high degree offensive or defensive qualities, and the only justification for the sacrifices made to speed would be to insure that the enemy was weak where the attack was to be delivered.

A study of naval tactics justifies the existence of torpedo-boats, destroyers, light-draft gunboats, small armored cruisers, and battleships. Uses can be found for other types, but they can only be justified by exceptional circumstances and not by the ordinary course of events in time of war.

Prof. P. R. ALGER, U. S. N.—Mr. Taylor's paper is a challenge to show cause for a belief in the supremacy of speed among the factors whose combination measures the offensive and defensive power of warships. Is the possession of two, or even three, knots greater speed an advantage sufficient to balance an overwhelming superiority of gun power and of armor protection? Certainly in the crucial test of battle, superiority of speed would count for almost nothing in comparison with superiority of armament. The Maryland, with full bunkers and full ammunition supply, will have a displacement of 14,875 tons, and is a much larger ship than any we have thus far built. What would the country and the world at large think of her commanding officer if he should decline combat with any single hostile ship he might meet? Public opinion will demand, and rightly, too, an ability to fight commensurate with size and cost. And yet what chance would the Maryland have if he met a hostile Virginia, and of what possible advantage would her greater speed be to her excepting as enabling her to escape certain defeat and destruction by flight. It is true that more Marylands than Virginias can be built for a given sum—Mr. Taylor says 5 of the former as against 4 of the latter type—but supposing a squadron of 5 Marylands to engage a squadron of 4 Virginias, can anyone doubt the result? Only under exceptionally fortuitous circumstances could any projectile fired by the Maryland pierce a vital part of the Virginia, while every hit of one of the latter's 12-inch guns would do serious damage. In fact, a vessel like the Virginia, if her armor were distributed with a special view to contend with vessels like the Maryland, might remain for a long period under the fire of a whole squadron of

Marylands without suffering any serious diminution of offensive or defensive powers. As the ships stand, in my opinion, five or even six Marylands would have no chance whatever in action with four Virginias. Are there, then, in other fields than that of actual combat, any advantages of superior speed sufficient to counterbalance this great inferiority in fighting power? I can only say for myself that I am unable to find them.

Lieutenant S. E. W. KITTELLE, U. S. N.—In answer to the questions asked in Naval Constructor Taylor's article, I am of the belief, for a given expenditure of money, and we shall probably always be thus limited by Congress, that it would be the wisest policy to build seven enlarged Virginias of 21 knots trial speed, or eight of the present Virginia type, rather than a combination of four Virginias and five Marylands.

Our building policy, if we had one, should be based upon the strength of possible antagonists, with a view to providing a preponderance of strength in our favor. Conditions seem to preclude hostilities with Great Britain at any time. Setting aside sentiment and considering only facts and monied interests, it will be seen that of England's annual consumption of breadstuffs, she produces only 22 per cent and imports 78 per cent, of which 50 per cent comes from the United States, the remaining 28 per cent from Russia and Argentina. This takes no account of the large shipments of beef imported from the United States. Vast sums of English capital are invested here and much American money is being used to develop English underground railroads and other enterprises. These conditions, coupled with a common language and a similarity of interests in many ways, should be enough to make both nations avoid hostilities.

A navy is needed to protect commerce and defend the sea coast and foreign possessions, consequently the greater these interests are the greater the navy needed to defend them. As a measure of commerce, the value of exports may be fairly taken, as it is the export trade that is sought after. The export statistics are as follows:

Great Britain	$2,648,711,578
United States	1,255,494,358
France	926,979,000
Germany	906,335,178
Russia	362,674,000

From the above alone it may be argued that we should have the second largest navy, but taking into consideration the exposed sea coast and large distant colonies of France, and the vast empire of Russia, with so few seaports that without a powerful navy she would be liable to a close blockade, it is believed that France and Russia will, during the next five years, continue to hold the second and third places respectively. The present sea interests of the United States make it necessary that we should hold not lower than fourth place in the maritime strength of nations, which place is at present held by Germany.

In order to attain fourth place it will be necessary to consider what strength Germany will have and to arrange our building program so as to give us a somewhat greater strength. The law governing the building program of Germany provides by 1916 38 battleships and 20 armored cruisers, but the wording of the law permits this large fleet to be constructed by 1908, and it is a constructive possibility to complete it in 1906, if an emergency should require.

Our navy, therefore, by 1908 should, in the line of battle, be stronger than that of Germany. We now have 17 battleships and 11 armored cruisers, built and building. We should, by 1908, have at least 38 battleships and 20 armored cruisers. As Congress failed to authorize any ships this year, we have only seven years in which to build 21 battleships and 9 armored cruisers, or at the rate of 3 battleships and 1 2/7 armored cruisers per year. Under ordinary conditions, Congress will generally be willing to authorize four armored ships a year, and as our armored cruisers are at present more powerful than those of Germany, we can afford to ignore the question of armored cruisers for a period of five years and build instead four battleships annually. In this way we would, in 1906, have 37 battleships built and building, a force of sufficient strength to enable us to pause to reconsider our building program, and in the next two years, if conditions then require, build one battleship and three armored cruisers yearly, giving us by 1908, 39 battleships and 17 armored cruisers, built and building. This leaves the United States one battleship in excess and three armored cruisers in arrears of Germany, but in each type our ships are of superior size and offensive power, insuring us fourth place in the list of naval powers.

Lieutenant JOHN M. ELLICOTT, U. S. N.—My views upon the subject of this paper will appear at length in the pages of the PROCEEDINGS in an article on "Warship Design from a Tactical Standpoint." They were more briefly stated in an essay on "The Composition of the Fleet," published in the PROCEEDINGS in 1896 (Vol. XXII., No. 3, p. 541, last paragraph).

For tactical purposes we need two or three different elements in a fighting force on the sea just as we do on land. Unfortunately (from a professional standpoint) we have had no great fleet actions between modern warships which fully demonstrate in what characteristics the elements should differ, yet such fleet engagements as recent history records illustrate unmistakably, to my mind, the special value of armored cruisers. If the Japanese had had such vessels in the battle of the Yalu, one can scarcely believe that they would have allowed the crippled Chinese warships to get into Port Arthur. Again, granting equal morale and efficiency to the personnel on both sides at Santiago, the Colon would certainly have outstripped the Oregon, and no other vessels but the New York and Brooklyn could have prevented her from escaping. A Virginia, in a fleet engagement, might with probability have her battery and guns' crews placed *hors de combat*, and still be able to retire

from action with unimpaired speed. While in such a condition, however, a Maryland from the reserve could pursue her and force her to surrender.

I am a firm believer in the comparative method of studying land and sea compaigns, for the principles upon which each must be based are identical. The only extensive land campaign with up-to-date weapons and conditions is that which the British are now terminating in South Africa. Most instructive comments on that campaign are now to be found in the pages of foreign military periodicals. Such men as Captain Trimmel of the Austrian General Staff, Count Sternberg of the Austrian Army and Major Callwell of the British Army, all of them present in South Africa, point out with emphasis that no real progress was made against the Boers until the British organized and employed *mounted infantry*. Prior to that they sometimes won a battle at great sacrifice, but the elusive enemy, after a brief recuperation, was as ready as ever for combat. As I have tried to show, I believe that just such an analogous condition will be found to exist in future naval campaigns, and that we will find in our armored cruisers a much-needed mounted infantry of the sea.

In modern war, mounted infantry cannot be dispensed with unless soldiers had the swiftness and endurance of horses; armored cruisers cannot be dispensed with unless battleships can have the highest warship radius and speed.

Lieutenant A. A. ACKERMAN, U. S. N.—Although authoritative views have been specifically invited to this discussion, no presumption is intended in offering the remarks here set down; they must stand or fall according to their own merits.

In past discussions, when the present development of neither battleship nor armored cruiser was foretold, and when, least of all, did they appear as rival claimants for naval appropriations, the writer favored the building of both. It was the habit then to compare the armored with the unarmored cruiser, and in that light the reason for the former's being was clear and strong. It had much of the protection of the battleship and had lost not overmuch of the mobility and economic advantages of the cruiser. They were to be marauders, a type of commerce-destroyer, capable of blocking trade routes despite the convoying cruisers; able to make sudden descents on unprotected ports without suffering great hurt to themselves.

Our ideas as to the duty of the navy in time of war have greatly changed since that time. A war to be carried to a speedy and successful ending must be fought out. If our naval strength is to be frittered away in chasing the enemy's commerce from the seas, the war may last indefinitely. Such a program, too, presupposes a mean opponent; he is expected to humble his pride and sue for peace in order to continue trading, when it very probably may have been contentions over that trade which caused the war. Judging from the past, when it has been *our* trade which suffered through this method of warfare, the result

tends chiefly to exasperate without impairing the naval strength in any marked degree. In fact, it turns peaceful merchantmen into fighting bluejackets.

If the enemy is to be brought to a condition in which he may with honor sue for peace, or relinquish the claims made against us, it is either because his fighting strength is impaired or because he finds that he cannot impair ours; not because he finds that he is losing money through the more or less desultory capture of his merchantmen. This is especially true of those powers to whom the mere state of war means an immense loss of trade with us.

A nation aroused and in arms will not be sordid; even though leaders may doubt the wisdom of continuing a war, the people, as a people, once committed to a course they believe to be just will continue in it, and the only way to peace lies through loss of fighting strength whether the dollars have influence afterwards or not.

The opinion has grown to a certainty that the first duty of the navy in time of war is to fight. And in carrying out that duty, whether to await the enemy at our own threshold or to seek him out wherever he may be found, depends upon circumstances. However that may be, the idea that our battleships are to be relegated to the defense of harbors cannot be tolerated. They are not as good for the purpose as the much less costly and practically invulnerable forts; their special qualities, only obtained at vast expense, are thrown away; besides that, there never will be a sufficient number of them to distribute among even a few of our greatest ports to be able to meet such forces as an enemy could concentrate against them. The conclusion is irresistible that the navy in war must operate on a grand plan; ships and fleets must work in unison. For such work those ships are the best which are most able to carry out their part of the general plan; that are able to go where they are sent and to stay where they are put in spite of the efforts of the enemy.

We now insist that our battleships shall cruise, and they do so, almost at the same speed and in most cases as economically, or even more so, than the equally large but weaker types to which the armored cruisers have grown. The demand is for a cruising battleship, not an armored cruiser, and for this reason the latter has sought constantly to ape the former, and with such success that the only characteristics of the cruiser left her are the latter's weakness in battery and a comparative unprotection. It is true that she still retains an excess of speed of three knots over the battleship; that will be lost, however, as soon as it is decided to slightly lengthen the latter. On the other hand, the cruiser has gained as complicated an organization, a more numerous crew and as great a cost for maintenance as the heavier ship.

Taking the matter less generally, the question of cost may be discussed first. Our people as a rule do not object to a particular type of ship primarily on account of its cost so long as they feel that they are getting their money's worth. That is, that the ship will do what it is intended to do, is the best of its class and that the portion of the appropriation going into profits is not unreasonably large. It is not believed that

Congress would hesitate at the difference in first cost between a battleship and an armored cruiser if convinced that the country needed the former more than the latter. There are uses for all types from tugs to battleships, but the work of the last is superlatively important and direct, while that of all others is subordinate and indirect or desultory and indecisive.

It must be evident to all that, however liberal within probable grounds the plan of increase of the navy may come to be, the country's needs for such a defense are increasing at a far more rapid rate. The type of ship most certain to be found too few in our next war is the battleship. It is the one type which cannot be extemporized; the one type for which there is no substitute.

The question has been put whether to build four battleships or five armored cruisers with the same money. If our country needs sturdy fighters, able to give and take punishment, then the relative values of the two types as fighters should govern our decision. All other considerations are of minor importance and serve only to obscure the qualities which will be depended upon to bring the war to a successful close.

Naval Constructor Taylor has already explained that the steaming radii of the two types will be practically the same, but even if there was a greater difference in favor of the cruiser, the demand for more coal could not be greatly postponed, and so long as we lack coaling stations, it must be met in either case by slow-moving colliers. In fact, the real differences between the two types are that one has three knots more speed than the other, which has greater powers of offense and defense.

The armored cruiser is avowedly made inferior as a fighting ship to the battleships of the same date. In other words, every naval power with whom we might go to war possesses a number of ships which it would be folly for our armored cruisers to face. That means that they cannot go where they are sent, nor dare they stay where they are put if the enemy objects. The cruiser's speed may save her, although Naval Constructor Taylor points out how readily a battleship her equal in that respect could be designed; moreover, in war time not much dependence will be placed on those ships whose chief recommendation lies in their ability to run away from the enemy's line of battle.

The fact is, however, in war our armored cruisers, though unfit, will be expected to fight as battleships. Let us consider a duel between vessels of the two types. Both have a numerous battery of light guns, which, as they are of no avail against the casemates at battle range, will be left out of consideration; the same reason of range excludes the torpedoes which balance each other in any case. The battleship of the Virginia class has a one-inch thicker casemate than the Maryland, covering approximately one-third greater area. It would be most extravagant to regard the extra 6-inch gun in the broadside of the Maryland as neutralizing this great difference in protection. Let us suppose it, however, and also that the belt of the battleship, which is impenetrable to the cruiser's guns, is offset by the heavier protective deck on the latter. The two ships have then opposed in broadside, 4 8-inch and 7 6-inch

guns equally protected. If this reasoning is as liberal as it seems to be, the battleship could fight a cruiser on each beam on equal terms and yet hold her 4 12-inch guns in reserve for the *coup de grace*.

There is another view to be taken of the armored cruiser in action, should they elect not to attack battleships even when two to one. Their armor is penetrable under favorable conditions by guns of calibers carried not only by their own class but by many protected cruisers. Let the result of a fight with one of these vessels be, however, victorious, the disabling of one of the casemate guns means the loss of a considerable portion of her offensive powers. This is not the case with the battleship, which could continue on duty almost as formidable as ever, even though great havoc had been made in her casemates. The armored cruiser, after a fight even with inferior ships which had resisted with spirit, would doubtless have lost considerable of her fighting strength and be greatly in need of repairs.

It is evident that for some time the two types have been approaching each other and may ultimately coincide. Let us hope that this will soon occur, and when it does that it is brought about rather by increasing the protection and caliber of the cruiser's guns than by further reducing those of the battleship.

It seems almost axiomatic that if, no matter what the rest of the world is doing, it can be expected that our ships will be able to go where they are sent and stay where they are put, the art of waging war will become much more simple.

Lieutenant JOHN HOOD, U. S. N.—Nothing could be more timely or more directly to the point than the question raised by Mr. Taylor in his article on our new battleships and armored cruisers in the PROCEEDINGS OF THE NAVAL INSTITUTE for January, 1901.

Stated fairly, the question is, that the time has come for the adoption of a fixed naval policy in the construction of our fleet, and the selection of the best type or types of vessels that the fleet constructed with the many available shall be, on the whole, the most perfect fighting machine in existence, providing in the largest measure for a given expenditure, the best known means of offense and defense, in naval warfare, and how all this shall be done.

The question is so broad, including, as it does, not only the naval policy of the country, but strategy and tactics as well, that it is difficult to discuss it intelligently in a limited space, and only a few of the most important points suggested by Mr. Taylor's question will be touched on here as they occur to the mind of the writer.

Notwithstanding ingenious theories in regard to other weapons, changes of design in ships and armaments due to the advance of science, and new inventions of various kinds, the final arbiter of naval battles is and remains the gun and the man, just as it was in the days of Nelson and Collingwood, and the ship that can put into action the greatest number and weight of guns, fired with the greatest rapidity and accuracy, will prove the victor in naval conflicts to the end of time. The

most perfect type of gun-carrier yet designed by human ingenuity, and the one that can keep the sea and be ready to meet any enemy at all times and under all conditions is the modern battleship, and since to meet and destroy the enemy's ships is the first and primary duty of the fleet, it is an indisputable fact that the battleship is, and will always remain, the basis of any properly organized navy worthy of the name.

In any future naval conflicts, it is to our fleet of battleships that we must look for final victory and success; for all other components of the fleet are auxiliary only, however necessary and important they may be, and should be designed to the sole end of increasing the efficiency of and supplementing the usefulness of the battle fleet, rather than on any false ideas of a possibility of their replacing it.

Any true system of naval operations, either offensive or defensive, contemplates meeting and destroying the enemy at sea, or at least so crippling him that his operations will be frustrated, and *not* in waiting supinely to meet him on our own coasts, trusting to ingenious devices and strange weapons of very limited ranges of action to destroy him after he has gained the mastery of the sea. To accomplish this requires sea-going and sea-keeping ships of the highest powers of offense and the greatest fighting endurance, that are capable of meeting any enemy in battle, and this type is represented by the battleship only.

The battleship has, however, its limitations in that its size must not be unreasonably large, or we sacrifice its manœuvering and tactical qualities, which are absolutely essential to concerted fleet actions, not to mention the enormous increase in cost. This limitation in size imposes a corresponding sacrifice in speed to retain the full measure of fighting efficiency necessary, and to supply this loss the battleship must be supplemented by auxiliaries of greater speed and less cost, whose duty it is to discover and keep in touch with the enemy, destroy his auxiliaries when opportunities occur, and provide the battle fleet with the information necessary to meet and engage the enemy.

Some remarks on the subject of battleship speed will be made further on, but it may be stated here that, in the opinion of the writer, the limit to both size and speed for battleships for efficiency, has been reached in the designs for the Virginia and her class, and it is a question if their value would not have been increased by dropping a knot, or perhaps a knot and a half in speed, and putting the corresponding weight saved in coal and armament.

If the ideas suggested above of a battleship organization, with accompanying auxiliaries, be accepted, the adoption of a fixed policy of naval development should be easy of attainment, though there will probably be considerable differences of opinion as to the exact character and number of the battleships needed, as well as of the necessary auxiliary complements. It will, however, hardly be disputed by any one who has given any study to naval tactics and warfare that one of the first and chief requisites for efficiency in the fleet is homogeneity of the units of each of the components, and one of next importance is that the number of the components should be limited to the smallest number

required by naval warfare that money and effort may not be wasted and every member of the fleet be fitted to fulfill its designs. In other words, only such classes of vessels should be built as are required by the most approved thought on naval war, and the vessels of each class should be of the same general types and sizes. Otherwise the manœuvering and tactical qualities of the fleet are sacrificed, the power of concentration and concerted action impaired, and much money wasted in the production of freaks and vessels of little value.

All this is extending the question somewhat further than Mr. Taylor states it in his very admirable article; but it would be as well to include the whole fleet in the discussion, as it appears to the writer there has heretofore been as little plan and system in the development of the lesser branches of the fleet as in that of the greater, and the adoption of a plan of naval construction should embrace all types necessary to and desirable for an efficient navy.

In determining what types of vessels are necessary to an efficient navy, it is well to keep always in view the purposes for which a navy is created:

1. First and foremost, to rush, fight, destroy or capture the enemy's fleet, and gain the mastery of the sea.

2. To defend our own coasts and outlying possessions.

3. To destroy and interrupt the enemy's commerce and communications and protect our own.

4. To police the ocean, afford help and protection to our citizens and commerce in disturbed countries, and maintain the honor and dignity of the flag and nation.

The nature of these duties clearly defines the types of vessels needed within very narrow limits.

For the first, as has been already indicated, are needed sea-going battleships of large coal capacity and of the greatest fighting powers attainable, with the necessary attendant cruisers of great speed and even greater coal endurance. Attached to this first fighting line, though there would arise cases when they must be left behind, should be the sea-going destroyers, whose size might profitably be increased to about 800 tons displacement, that they might be rendered truly sea-going and sea-keeping.

For coast defense proper, beyond that supplied by the battle fleet, are required torpedo-boats and submarine boats of the best design, that promise in the near future to prove the most efficient coast protectors yet designed. The construction of monitors and like craft for coast defense or other purposes seems to be a waste of good money that might far more profitably be applied to the battle fleet.

For the destruction of the enemy's commerce and protection of our own are required cruisers of the same type as those attendant on the battle fleet.

For the police of the ocean and protection of our citizens and flag in foreign countries, in places the battle fleet cannot reach, are required gunboats. Of these not more than two types are needed, cruising gun-

boats of about 1500 tons displacement, and smaller gunboats of about 500 tons displacement for river and inland water work.

Considering these suggestions, it seems to the writer that the following types of vessels, and no others, should be included in a well-conceived plan of progressive naval construction, and on them, in the proportion that will be discussed later, should be expended all the money available for naval construction purposes:

1. First-class battleships of the general type of the Virginia.
2. Armored cruisers of two classes—(*a*) a limited number of the general type of the Maryland, and (*b*) the cruiser fleet proper of the general type of the Brooklyn.
3. Torpedo destroyers or cruisers of about 800 tons displacement.
4. Torpedo-boats of a uniform type of about 150 tons displacement.
5. Submarine boats of the latest designs.
6. Gunboats of two classes—(*a*) cruising gunboats of a general uniform type of about 1500 tons displacement, and (*b*) river and inland water gunboats of about 500 tons displacement.

We have, of course, at the present time a large number of intermediate cruisers of types almost as variable as their number, and these should be used to the best advantage as long as they last. But in planning for the future, it would hardly seem that any of them are worthy of repetition, for their minor duties can be equally well and far more economically performed by the cruising gunboat class, and their higher duties would be infinitely better performed by a lesser number of the larger cruisers of the class (*b*) type suggested above, and the battle line much strengthened at the same time. Similarly, we have on hand or building a variegated conglomeration of torpedo crafts, many of them of undoubtedly excellent design that will prove very valuable additions to the coast defense of the country. They would prove far more valuable still, from the increased efficiency of their crews when formed, had all of them been of standard pattern. The rule for their construction in the future should be unity of design with the best type selected as a model.

As before stated, the battleship is the foundation on which all future naval projects must rest. Its characteristics should be fighting power enough to overcome and speed enough to join combat with any enemy's vessel of its class. Its *first* requisite, however, is the power of fighting and resistance, and, its *second*, speed; and the first should never be sacrificed for the second. In the vessels of the Virginia class, it would seem that this question of battleship speed had reached the limit of its usefulness, and any further increase would cause either a great and unnecessary increase of cost, accompanied by unwieldiness of size and loss of manœuvering and tactical powers, or an unwarrantable loss of fighting power. For, as so clearly shown in Mr. Taylor's contrast of the battleship and armored cruiser, it is all a question of weights or cost or both. For a vessel of given size, all that goes into extra speed is just so much deducted from armor, armaments, coal or other essentials, and it would scarcely be called wise to sacrifice the main object

for which the ship was designed to attain an extra knot or two of speed that a couple of months of marine growth on the bottom will destroy, and that the vessel will rarely, if ever, be called on to make. Battles will never be fought at nineteen knots, and such speed is only needed by battleships to bring an unwilling enemy to action. Nineteen knots, or even a little less, is sufficient for that purpose in the case of any enemy's battleships we are likely to encounter, and the task of overhauling his fastest cruisers must be left to our vessels of the same class. The limitations of nature, and of human nature as well, are contrary to the combination of the battleship and cruiser in one, and any attempt to do so will prove a failure, both from its great cost, and from the lack of manœuvering and tactical qualities in the enormous vessel the combination would produce.

In regard to the two classes of cruisers advocated in the above list, both are necessary under existing conditions, though both cost and tactical considerations would point to one only. For the ordinary purposes for which cruisers are used, class (*b*) alone would be sufficient and desirable. But since all the leading navies of the world have, or are building, vessels of the type of class (*a*), necessity compels us to be provided with a limited number of the same type to be able to meet them on equal terms, or else run the risk of having our other scouts and cruisers fall an easy prey to a superior enemy. The number of these vessels should, however, in the opinion of the writer, be limited to the necessities imposed on us by our possible adversaries, and our chief care should be the increase of the line of battle and fleet of scouting cruisers of class (*b*).

Turning to the subject of torpedo-boats and destroyers or torpedo-cruisers, it is quite thoroughly recognized now by all authorities that the field of usefulness of the torpedo-boat proper lies in coast and harbor defense when the boat acts from a base.

But the larger field of the destroyer and torpedo-cruiser is still an unsettled question. It is the opinion of the writer that by increasing the size of the destroyer somewhat, it can be made sea-going and sea-keeping for a long enough time to be a most valuable adjunct to the sea-going battle fleet. There would undoubtedly be some expeditions on which even the enlarged destroyer would be a hindrance rather than a source of strength to the battle fleet, but in much of the work, and on many occasions, they would be most efficient scouts, and could take advantage of favorable nights for torpedo attacks on the high seas, while their great speed would always enable them to avoid a superior enemy by day. The size of 800 tons suggested above may not meet with the approval of the best authorities, but the subject is a matter well worthy of consideration in formulating a plan for naval development.

Summing up the foregoing remarks in an answer to the question, somewhat broadened, propounded by Mr. Taylor, the writer would say that he is of the opinion that a definite naval policy should be adopted, and with it a settled plan of naval construction founded in a fleet of so many battleships, the number being the key to both policy and plan.

He would, himself, suggest at least 30 battleships in active service at the end of a period of 10 years, this to be increased by 10 more at the end of another period of 5 years, by which time some of the older ones would be in reserve.

For every two battleships built he would recommend one (1) armored cruiser equal or superior to the most powerful cruiser built in any navy at the time.

For every battleship built, he would build one armored cruiser of the class (*b*) noted above, one enlarged destroyer or torpedo-cruiser and two torpedo-boats.

For every three battleships built he would build one (1) submarine boat of the latest design.

The number of gunboats of the two classes needed would be regulated by the exigencies and conditions of the times. For the present, the number of gunboats and small unarmored cruisers we already have, or are building, will serve the purpose, and they need not be considered, and all the money available devoted to the construction of the other branches of the fleet on the lines laid down above.

In the construction of this fleet, the most excellent design of each of the types of vessels recommended should be selected as a model, and the design be adhered to, only varying it in detail in the case of some important new discovery, so that each class will be practically uniform and homogeneous.

Having made the plans, designs and estimates for the scheme of construction recommended, and found that less money would be available in the time than the plans called for, the proportion of the various classes should be preserved and the construction extended over a longer period of years, though delay may prove fatal in the present condition of the navies of the world and the political aspect of affairs in the East, for our next enemy will not be Spain, nor will a converted yacht, a tug, and a gunboat prove an efficient line of battle in the next war.

Lieutenant E. W. EBERLE, U. S. N.—I have read with much interest the valuable paper on "Our New Battleships and Armored Cruisers," by Naval Constructor D. W. Taylor, U. S. N., and it merits very careful thought and study. If the line officers of the navy will study this subject and give their candid opinions in future numbers of the PROCEEDINGS OF THE NAVAL INSTITUTE they will not only fulfill the object of Mr. Taylor's excellent paper, but at the same time they will render the navy a great service, because the opinions of the tactical officers are of the highest value in the development of a sound building policy.

I fail to see either wisdom or plausible theory in a policy that requires the building of armored cruisers of 12,000 or 14,000 tons displacement. Even the ardent admirers of large unwieldy Marylands cannot claim offensive, defensive, or tactical merit of very high order for those vessels. At two thousand yards' range the Maryland's guns give her no offensive merit, her armor gives her no defensive merit, and although she is credited with very high speed, her manœuvering

qualities in the line of battle at the above range is seriously compromised by her great length and enormous displacement. Compare a Maryland with the Argentina's San Martin (and improved Colon), a vessel of about 7000 tons displacement, and judge from their offensive, defensive and manœuvering qualities, you would quickly choose the smaller vessel as the winner in a "stand-up" fight. I will admit that a Maryland could decline a challenge to fight by taking advantage of her phenomenal speed, but it would be very demoralizing to the spirit of the crew, and would rudely shock the high moral enthusiasm of the country, to have the large 14,000-ton Marylands run away from vessels one-half their size.

Why do the friends of the Maryland class cling so persistently to their favorite argument that the speed of these vessels will enable them to decline a fight and escape? History proves that battles never have been won by *running away*, and I feel safe in asserting that battles never will be won by such tactics. Let the enthusiastic defendants of these large unwieldly armored cruisers, whose main defense and greatest merit lie in their *escaping qualities*, take to heart that wise quotation: "For he who fights and runs away, may live to fight another day." During hostilities, the time will come when these vessels will be forced to fight, and they should be given the offensive and defensive qualities that will enable them to make a hard fight for vessels of the armored cruiser class.

Why not take an improved Colon as our armored cruiser type, and limit the displacement to 9000 tons. This displacement should enable us to build a vessel carrying armor of moderate thickness and a heavy battery, and at the same time possessing high speed and good manœuvering qualities. Such vessels would make efficient scouts for the battle-fleet and would occupy important places in the line of battle.

For distance scouting duty we can find nothing superior to our fast transatlantic liners. Armored cruisers should be selected, invariably, as scouts for the battle-fleet, because, after locating the enemy, it may devolve upon them to bring on the engagement; or in the case of a retreating enemy their duty may be to harass and detain the enemy until the battle-fleet arrives to give the crushing blow.

The statement that armored cruisers should form a part of the battle-fleet cannot be contested, and, therefore, they should be designed for that service and be able to deliver and receive "hard knocks," and to manœuver with great celerity. Battleships will constitute always the main line of battle, and we must look to them to bear the burden of the offensive and defensive work. For this reason we should devote all our energies to building powerful and efficient battleships, not battleships which are the equals of those of other countries, but which are superior in gun-fire, in endurance, and in armored protection. Why should we sacrifice armor, armament and endurance to higher speed. Build a battleship with complete armor protection, carrying a heavy battery and capable of maintaining a sea-speed of eighteen knots, and we shall have the ideal vessel. A sea-speed of eighteen knots will not require a sacrifice either of armor or armament, but if we strive to

obtain a higher speed in a battleship, the fighting qualities must suffer necessarily.

To my mind, the batteries of our battleships should be increased, and I will repeat here what I stated in a paper published in the PROCEEDINGS in March, 1898:

"The most important subjects in battleships are the armament, armor and ammunition supply; and all else, excepting the engineering department, must be sacrificed for these three main fighting qualities.

"When the United States Government commenced building a navy, the policy was to have her ships armed with *more guns* and with guns of *greater range* than were carried by the war vessels of other nations. That policy was carried out in our early wars, and history records the splendid victories, and these victories were made possible by the large number of long-range guns carried by our ships.

"Up to the time of designing the battleships that are now on the stocks, our uninterrupted policy had been to build ships that excelled in battery all foreign ships of the same class, and our Oregon class maintain this policy, as their eight-inch guns far outclass the six-inch guns of foreign battleships. The Kearsarge and Kentucky are somewhat doubtful about maintaining our cherished policy, as many look upon their superimposed turrets with a skeptical eye. However, in our latest battleships we have completely abandoned the policy that we had held to for a century, as these ships are designed to be the *equals* of foreign battleships in armament, gun for gun, and *not superior* to them. We have abandoned the splendid eight-inch guns which made our Oregon class superior in armament to any ship afloat, and now we have nothing but six-inch guns to back up the thirteen-inch. I think this is a very unwise departure from the policy that always brought us victory in our past wars; and should our Alabama class engage with ships of the same class I fear that the victory would hang in the balance, while it would be insured had our ships been given the eight-inch guns. I consider the forty-caliber eight-inch gun a superb piece of ordnance, and one that we can ill afford to dispense with in our battleships, although I do not commend the eight-inch turret mounts in the Oregon class. Those turrets simply invite disaster, as they are perched high in the air, with only a four-inch armored ammunition tube underneath them for protection.

"It appears that the tendency in the British navy, and I regret to say in our navy, is to reduce the number of guns and to increase their arcs of fire, and also to have no guns above six-inch caliber for supporting the twelve- or thirteen-inch. This method of decreasing the number and caliber of guns is an ideal theory for reducing weights; *but ships are built to carry guns and to fight*, and it would seem better to reduce weights elsewhere than in the battery and ammunition. A comparatively small number of guns are thus placed on board our new battleships, and each gun commands a large arc of fire; but the theorist does not consider the fact that one shot may disable a gun, and then a large arc is without a gun to cover it. I believe in a large number of

guns with reduced arcs of fire, for then you will have more guns in proportion at all stages of the battle, and, if necessary, the ship can be manœuvred to bring the last guns to bear. If every gun in the ship's armament is to have an extensive arc of fire, then it is impossible to carry many guns, and when these few are disabled the ship is defeated. I do not see how a battleship can have *too many guns*, even if they are placed side by side; and to me it seems a sin to build a great battleship of 12,000 tons like the Alabama and give her a main battery of only four thirteen-inch and fourteen six-inch rifles.

"In the present age, when heavy fighting ships cruise in fleets, naval engagements between single ships will be rare; consequently, during battle, each ship of a fleet will have no trouble in finding enough of the enemy's ships to serve as targets for all the guns of her battery, and there need be no fear of some guns not bearing on the enemy's vessels. Therefore, I claim that the ship that mounts a large number of guns with small arcs of fire will be superior to the ship with fewer guns and large arcs of fire. The former vessel will be able to deliver many more pounds of metal against the enemy's various ships; and contests between fleets of battleships will be decided by the weight of shell thrown by guns of 6-inch caliber and above. Consequently, when we abandon the 8-inch guns in our new battleships we surrender the great advantage that we have always maintained over foreign ships, and we reduce our armament to the same plane as theirs. We should endeavor to retain the 8-inch guns in our broadside, because, like the past, the naval engagements of the future *will be fought with broadside fire* and not with a fore and aft fire.

"In an engagement between battleships of similar armor and displacement, which one will probably be the victor? There can be but one answer; for it will be the one that effectively delivers the greater amount of steel against the other ship. Give us guns galore, for the time will come when each gun will give a good account of itself, and our terrific broadsides will bring us victories as they have in the past.

"Let us hope that our battleships of the future will have complete armor protection; that the armor-belt will be in the right place when in war-time cruising trim; that they will not be burdened with so many boats and other peace-time encumbrances; that the 12-inch or 13-inch guns will be supported by 8-inch guns *en barbette;* that the rapid-fire battery of 3-inch guns will be increased, and that reserve forces of men and officers will be assigned to each ship, for then we shall possess ships which we can truly call battleships, as they will be able to stand up and give battle to anything that sails the seas under all conditions of wind and wave.

"In time of war the officers of the ship, and not her designer or builder, are the ones to be held strictly accountable for the fighting condition of the ship and for the result of battle, and it will be too late then to attempt to excuse defeat by attributing it to errors in the design, in the armament, in the ammunition supply, or in the practical equipment of the ship. Therefore, I believe that healthy criticisms and practical

suggestions by the sea-going officers who man our battleships and fight the guns should be very acceptable to those in authority who create our naval policy; and also to those who are entrusted with the work of designing and constructing our great national defenders, and who have not the opportunity of observing the practical behavior of these ships at sea."

Consider seriously the recently designed battleships of the Italian navy, which carry three 12-inch and twelve 8-inch guns in the main battery, on a displacement of 12,600 tons. What a superb and homogeneous battery we would have in our battleships of 15,000 tons, if we should give them four 12-inch, fourteen 8-inch, and twenty 3-inch rifles. A fleet of such ships would prove, in its power and homogeneity, invulnerable and superior to any fleet in the world.

As a final answer to Mr. Taylor's questions, my building policy would be as follows:

Build a moderate number of destroyers and torpedo-boats, and do not put torpedo-tubes in any other class of vessels. Build a large number of light-draft gunboats; do not build any protected cruisers; do not build any Marylands, but build a few armored cruisers (about one to every four battleships) of 9000 tons or less displacement, and carrying 8-inch and 3-inch rifles; build a large fleet of battleships and devote our main energies to building them, but let our Virginias be thickly and completely armored, carry four 12-inch, fourteen 8-inch, and twenty 3-inch rifles, have eighteen knots sea-speed, and have large coal and ammunition capacity. Man a fleet of such battleships with the personnel of our navy, and the Government may feel well assured of success.

Further discussion is invited.

Reply to Discussions in No. 96, on Paper Entitled "Torpedo Operations in Naval Warfare," Published in No. 95.

Lieutenant L. H. Chandler, U. S. N.—It had been my original intention not to reply to criticism, fearing to weary the Institute's readers, but owing to the fact that considerable new matter has been presented in the discussion, I cannot refrain from expressing my opinions in regard to certain parts of it. While I appreciate highly the attention that has been given to the lecture, I cannot attempt at this time to reply to everything that was presented in the discussion, but will devote myself in the main to three principal points brought out by Captain Goodrich, Lieutenant-Commander Chambers, and Lieutenants Ellicott and Hood. In so doing I wish to thank all for the courtesy with which they have treated my efforts and for the useful and interesting ideas that have been advanced. My not replying to all of them is due to lack of opportunity and not lack of inclination. I may say to all, though, that I hope the time will soon come when we will be allowed to work out our differences together upon the water instead of on paper. Until that happy time, I know of no more instructive pastime than these present discussions.

The three principal points in the discussion to which I have already referred as being of the greatest interest are as follows:

(*a*) The question of torpedo fire at a pursuing vessel from tubes aboard a heavy ship, as suggested by Lieutenant-Commander Chambers.

(*b*) The question of the coast district system as raised by Captain Goodrich.

(*c*) The theory of section attack as against "dispersion for search; concentration for attack," as criticised by Lieutenants Ellicott and Hood and epigrammatically characterized by the former.

These three topics will be touched upon in the order named.

(*a*) Torpedo Fire at a Pursuing Vessel from Tubes Aboard a Heavy Ship.

I am free to confess that Lieutenant-Commander Chambers has furnished me with a number of ideas that had not occurred to me before, several of which I am very glad to incorporate as a foundation for a change in one of my beliefs. I have found in these remarks a valuable use for the torpedo from big ships that had not before held a place in my mind.

I wish to say, first, that I quite agree that a shop adjustment of the gyroscope is mechanically possible and will no doubt be reached before long, and that when it is reached the usefulness of the weapon will be greatly increased. While this will render the torpedo far more formidable, especially as used from heavy ships, at the same time I do not believe that it will very greatly extend the radius of action of torpedo vessels, and that such craft will always have to work from some sort of base, fixed or movable, but in any event said base must be in still water.

As far as the question of setting tubes and gyroscopes aboard boats is concerned, I am of the opinion that the setting proposed by Lieutenant-Commander Chambers would not be so good as that proposed in my lecture. It seems to me that we can at least assume an ability on the part of each boat to head for an enemy long enough to discharge the three torpedoes, and by Lieutenant-Commander Chambers' setting the use of one torpedo is practically sacrificed to the idea that the target cannot be held for a time on a right ahead bearing. For any kind of retreat, either by passing or by turning immediately after fire, it seems to me that to bring the enemy right ahead until the fire is delivered is the only possible manner of getting the best results.

It will be noted in Section 27 of my lecture that, although not specifically mentioning the retreat by passing the enemy, I leave that question as a doubtful one. This whole matter is one that only practical experience can decide, and I look forward with eagerness to the time when we will be able to do tactical boat work under the guidance of officers who have had both theoretical and practical education in torpedo warfare prior to any manœuvres which may be undertaken to prove or disprove the theories that I have set forth. The manœuvres at Newport, last summer, to which I shall refer later, were carried on by men who had practically none of them ever done any such work before, as I think I am safe in saying that there is hardly an officer or man in the

Navy who had had up to that time much experience of the kind. I include myself among the number of inexperienced ones most unreservedly. I therefore claim that the work became almost entirely an instruction to individuals, and much was learned from it. We all discovered how prone a torpedo-boat officer would be to mistake his distance and fire when far outside of torpedo range, etc. Of course all these points were of the utmost value to us, but I claim, and I think I will be upheld in the claim by the service at large, that in order to prove or disprove tactical theories, the manœuvres must be conducted by men who are already adepts in these A, B, C matters which came as surprises to us all at Newport. In other words, the work done there was excellent for purposes of elementary instruction, and a number of nights of it would make torpedo-boat officers sufficiently familiar with surrounding conditions to enable them to go ahead and develop theories in regard to the tactics of attack and retreat. I hope we may soon have the chance to do this.

TABLE SHOWING RANGE AT WHICH A TORPEDO CAN BE FIRED AND HIT AN ENEMY IN DIRECT PURSUIT.

Speed of pursuing enemy, in knots per hour.	Torpedo tactical diameter 300 yds.				Torpedo tactical diameter 600 yds.			
	Speed of torpedo in knots per hour.							
	15	20	25	30	15	20	25	30
	Range at which to fire to hit.							
12	671.5	583.7	522.9	489.1	1343	1167.4	1045.8	978.2
13	702.5	607.4	541.5	504.9	1405	1214.8	1083.0	1009.8
14	733.5	631.1	560.1	520.7	1467	1262.2	1120.2	1041.4
15	764.5	654.8	578.7	536.5	1529	1309.6	1157.4	1073.0
16	795.5	678.5	597.3	552.3	1591	1357.0	1194.6	1104.6
17	826.5	702.2	615.9	568.1	1653	1404.4	1231.8	1136.2
18	857.5	725.9	634.5	583.9	1715	1451.8	1269.0	1167.8
19	888.5	749.6	653.1	599.7	1777	1499.2	1306.2	1199.4
20	919.5	773.3	671.7	615.5	1839	1546.6	1343.4	1231.0
21	950.5	797.0	690.3	631.3	1901	1594.0	1380.6	1262.6
22	981.5	820.7	708.9	647.1	1963	1641.4	1417.8	1294.2
23	1012.5	844.4	727.5	662.9	2025	1688.8	1455.0	1325.8
	Tor. runs 471.43 yds., in a 180° change of course, in given times. At 30 knots in 28 seconds. " 25 " 33 " " 20 " 42 " " 15 " 55 "				Tor. runs 942.86 yds., in a 180° change of course, in given times. At 30 knots in 56 seconds. " 25 " 1 min. 6 secs. " 20 " 1 " 24 " " 15 " 1 " 50 "			

Lieutenant-Commander Chambers makes one statement that I must take exception to, and that is where he says of the gyroscope adjustment that "the adjustment is simple and can be made almost instantly at the side of the tube, etc. . . ." This I challenge. Mr. Chambers is thinking of the above-water tube, which is now practically abolished, and, I believe, properly so, from heavy ships. With the submerged tube no such method of setting has as yet been designed, and its accomplishment is surrounded by many difficulties. So, for the present, I cannot accept the above statement relative to this point, for I consider the dis-

cussion of above-water tubes for heavy ships as practically useless, and so confined myself in the lecture to the new Maine class of ships with submerged tubes only.

Passing from these somewhat discursive matters to the question at issue—that of torpedo fire at a pursuing ship—I must admit that I am thoroughly in accord with all that Lieutenant-Commander Chambers says. The approach from astern by a faster ship that desires to ram is very apt to occur, and can, of course, be always brought about by the attacked ship.

If, therefore, the attacked ship causes her pursuer to follow directly after her, the stadimeter may be used to determine the exact speed of the pursuer, as well as her distance at any given moment.

The foregoing table could, therefore, be used to determine with the utmost accuracy the proper elements of fire for a style of defense that would make the pursuer very unhappy.

From this table will be seen how vastly this method of fire increases the effective range of the torpedo, by allowing the pursuing ship to cover part of the intervening distance herself. It will also be seen that the greater the tactical diameter of the torpedo and the less its speed the further apart the two ships could be at the moment of fire and still score a hit. Thus we see qualities that are ordinarily classed as disadvantages in the torpedo, slow speed and great tactical diameter, are here qualities of positive value. The limit would of course be that the run must be made quickly enough to prevent the enemy from seeing and avoiding the torpedo. Unless the sea is dead smooth, however, it is very hard to follow the track of an approaching torpedo, and with a double fire from the foremost ship resulting in a torpedo approaching on each side, dodging would be a very hard matter.

In this connection, I am much impressed by the facility with which this method of torpedo attack could be used in conjunction with the system of concentration of gun fire, recommended by Professor Alger in his treatise on the "Errors of Gun Fire at Sea." A ship which follows his method of steaming in a spiral in order to keep an enemy in his zone of maximum gun fire, could readily resort to this method of torpedo warfare if desired. To bring the enemy astern long enough to deliver the torpedo fire by the use of the above table would be very easy, and perhaps a similar table for torpedo fire while still on the spiral might be prepared also. This would of course be preferable, and while the preparation of the table would seem at first blush to call for an application of more than simple mathematics, at the same time such a table, if it can be prepared, would be about as simple to use after it is once prepared as the one given above. As yet I have not had time to inquire into this point very fully, but promise myself to do so at the first opportunity.

To fit torpedoes for use with this table, there will have to be furnished with each torpedo a tabular statement of the number of turns of the regulator to secure any one of the given speeds on the semi-circumference of the circle; also some arrangement must be made for securing

the desired tactical diameter. To do this I believe two sets of vertical rudders could be filled, capable of being readily inserted in the tail blades or removed from them as desired. The larger set could be used for a 300-yard diameter, and the smaller one for a 600-yard one. These two points present no difficulties that could not be readily overcome at the torpedo station.

(*b*) The Coast District System.

In replying to Captain Goodrich's objections to my system of coast districts, I wish to state, first, that it has never been my idea to free the torpedo sections from the control of the commander-in-chief or senior officer present in time of war, as I of course realize the foolishness of any such proposition. My only idea in regard to protecting the sections from commanders-in-chief and casual senior officers present in time of peace, was to enable the torpedo-boat officers to continue their proper work without having their boats called upon at the pleasure of any passer-by to run errands, carry despatches, transport wash-clothes and marketing, etc. That the danger of this improper diverting of boats from their true duties is no imaginary one is proved by the fact that they have always been used for such purposes far too freely, even during the Spanish war, and I fancy no one will doubt what would be their fate in the matter in time of peace unless amply protected by departmental orders.

Captain Goodrich in his criticism, as well as in a previous one on my essay of January 1, 1900, objects to my coastwise district system as a division of force to be deprecated. The comparison of my scheme with the Jeffersonian gunboats is, in my opinion, not a fair one, for the gunboat scheme was to have those small vessels in the various ports and *no other naval force anywhere*. I certainly have never advocated the coast torpedo-boat system to the exclusion of all other force afloat.

The coast system as I devised it was to furnish at any point a well-trained force of torpedo vessels, with officers thoroughly familiar with the locality, upon which the commander-in-chief of the fleet in being could freely call for whatever war service they could render him. With our tremendous length of coast-line, I can see no other way in which this can be done.

Captain Goodrich criticises my system because it divides the force. True, and I am the first to admit that a smaller force with the fleet would answer every purpose, *provided such force could be kept in efficient condition* and still cruise with the fleet. His criticism is a tearing down of the system which I evolved, and the reasons given for it have much weight, even in my own mind, but I am constrained to advance the point that while Captain Goodrich has torn down my structure, he has not, in either of his criticisms, erected anything in its place. I should be more than glad to hear what his ideas on the subject are, and exactly how he thinks the boats should be kept in being.

If any inference can be justly drawn from his remarks, it is that the boats should serve with the fleet regularly, as a component part thereof. I leave the possibility of this to the judgment of individuals. Personally,

I am confident that were it attempted we would have boat after boat left behind for repairs, with officers and men played out and machinery broken down, until the smaller force that Captain Goodrich considers all that is necessary would have accomplished a more thorough dispersion than any dreamed of in my system, and with this difference, *that his fewer boats and men would be broken down*, while my greater number of boats would be in prime condition, with officers and men physically sound and keen for the encounter.

That my system will demand more vessels is true, and my table gives 231 as a maximum. With far less coast-line than our own, England has 96 destroyers and 165 boats, making 261 in all, with 13 more boats owned by her colonies; France has 31 destroyers and 277 boats, making 308 in all, with 10 submarines besides; and Germany has 154 in all. These figures are taken from the only edition of Clowes' Naval Pocket-book that I have at hand, that corrected to February 1, 1899, and must undoubtedly be considerably increased to bring them up to date. Considering these figures, with relation to the comparative needs for defense of these countries and our own, I am content to leave the question as to whether or not my figures are excessive to those who read.

(*c*) The Theory of Section Attack as against "Dispersion for Search; Concentration for Attack."

The question of group search and dispersed attack is one to be solved by practical work alone. This I admit. I long to see officers and boats given a chance to work it out under proper conditions.

I am well aware that if the boats could be given "dispersion for search" and "concentration for attack," to quote Lieutenant Ellicott's final words, the maximum efficiency would be obtained, but does his method as proposed accomplish it?

As I understand it, his idea is to take the force at his command, say two sections, fourteen boats, and turn them loose separately, each boat to be at a certain place somewhere out on the water in the dark, at a certain time. There will be no means for a man in command of a boat to tell when he is in his place, except it be so close to the shore as to enable him to recognize the land, for certainly light-houses, etc., will not be available.

Then the boats, each being in a supposed place (fourteen watches to coincide, and no mistake made in estimate of time to reach a given unmarked spot), they are all to steam in at slow speed towards another supposed spot, and in case any one boat sees anything, she is to trust to luck to get more boats to help her concentrate on it. When done, the victim will more than likely prove a friend also. With the experience born of one night's prowling, I am willing to stake my reputation on the difficulty of telling whether a certain dark mass in view at night is an enemy's battleship or a friend's torpedo-boat.

I believe that no greater confusion worse confounded could be secured than by the method recommended in these two criticisms.

The idea of going out and annihilating an enemy's whole fleet in one night is attractive, but, to me, chimerical.

The time element must be eliminated to the utmost degree possible. One boat alone has very little chance with a battleship even under the best of circumstances. These are axioms to me.

To avoid depending on the time element, and to ensure that more than one boat shall attack the enemy at the same instant, the officer in command must hold his boats together until the last moment. This the wedge formation accomplishes, and while it does render finding the enemy more difficult, it may be said that if an enemy cannot be found in that way, in say a week, it would seem to me that his blockade must be rather a farce.

So that while I admit that all Lieutenant Ellicott urges against the group search in his (*a*), (*b*) and (*c*) is true (boats must go slowly when in vicinity of the enemy to minimize (*b*)), at the same time I dissent utterly from his finding on the premises. The disadvantages that he urges, must be submitted to in order to accomplish anything. I am confident that the haphazard concentration he suggests would, if relied upon, simply result in the destruction of the boats in detail. Remember, they must avoid or run over pickets, etc. Seven boats, or even five, if they can get anywhere in the vicinity of a ship, can, in my opinion, run through the best picket force available, and while some of them are drawing the enemy's fire the rest can get a chance to fire their torpedoes. In other words, one battleship and her pickets could probably hold up one, two or three boats before any of them could deliver their torpedo fire, but if five, six or seven go in together, I do not believe that any human power could stop them all outside of torpedo range.

Although doing so will perhaps furnish my opponents with arguments against what I have just set forth and in favor of the dispersed search idea, I nevertheless desire to give an account of the conclusions I drew from the Newport manœuvres of last summer.

These manœuvres were originally intended to cover a week's time, but were from various causes cut down to two nights. Then, in order not to wear men out, the operations on those nights were all ordered to be terminated by midnight the first night and by eleven o'clock the second. As torpedo work depends to an exceedingly large degree on the nervous strain and physical exhaustion under which the enemy is kept for perhaps many nights prior to the real attack, and upon the element of surprise, it will be seen at once that the orders just quoted at once deprived the torpedo-boats of practically all the natural advantages that would ordinarily militate in their favor. Please keep these conditions in mind in reading what follows, and allow for the tremendous loss of efficiency that necessarily resulted to the boats from their enforcement.

The first night of the manœuvres was given up to a spectacular passage of the Newport forts by a squadron of battleships, prior to which the torpedo-boats had been sent in to attack the inside ships. This was ordered to be done between eight and twelve at night, and on a particular night. Naturally the boats were discovered and mostly put out

of action. They had orders to steam in anyhow, to save time, regardless of whether they were discovered or not, so that if a torpedo-boat officer discovered that his foes were on the alert at a particular point, instead of turning and trying another, as a man would do in time of war, he was forced by order to push ahead and sacrifice himself under the guns of forts and ships in order that the crews of the battleships could be allowed to get to sleep at midnight. Certainly true tactical considerations never dictated these conditions. As it was, one boat, the Stiletto, got in and torpedoed the Massachusetts. The Holland was not allowed to participate in this night's work, the reasons for which I do not know.

On the second night the boats from inside were to go out and attack a blockading fleet. My claim is that the sensible thing to do in war time would have been to send the boats out together (there were but five, and a fine miscellaneous collection at that) and be content to get one of the enemy's heavy ships in a single night, and to leave the rest for another time, rather than to risk having the boats cut off in detail while skurrying around separately and before they could accomplish anything.

However, torpedo stock has been at a low ebb for some time in our navy, and at these manœuvres it would have been a fatal blow to the torpedo service had five boats only succeeded in getting one battleship on this occasion. Officers of the navy and the newspapers of the country would have joined together in crying out at the failure of the boats. I therefore believe that it was a wise comprehension of what I may call the politics of the occasion, and not any tactical consideration, that caused the attack to be delivered as it was.

Commander N. E. Mason dictated the method of attack, and I am confident that in time of war he would have carried out what I state to be the correct tactical method, but as it was in response, I believe, to the political considerations indicated only, he wisely abandoned sound war tactics and separated his boats.

The general plan of operations was laid down by the battleship officers again, and compelled the boats to finish their work by eleven o'clock in the evening, and on one fixed evening at that. These limitations themselves seemed almost enough to prevent the boats from doing anything. Being bound down in regard to time as he was, Commander Mason very shrewdly sent the boats out at dusk, and before the five ships outside were expecting an attack the Vicksburg and Scorpion (rated battleships for the occasion) were declared sunk and sent into port.

The Holland was out that night also. Personally, I was aboard the Porter.

The search for the Kearsarge, Indiana and Texas was then continued. I believe that one of the boats (the Dahlgren, I think) found the Indiana and claimed to have sunk her, but that next day the umpires decided that the Indiana had sunk the boat. Nobody else saw the Indiana that I am aware of, and, as far as I know, she was so far to the eastward as to be of no use in a blockade of Newport.

At about 8.30 the Porter sighted a ship (the Kearsarge) and made for her, but before our attack could be made another boat (the Dahlgren) attempted her and was successful. Not knowing the result of this, the Porter made sure by continuing her effort and succeeded. At about the same moment the Holland attacked and also scored a success. Captain Folger answered the Porter's hail by saying that he had been successfully attacked, and turned on his lights and steamed in to an anchorage. The decision of the next day in regard to this engagement was that as the Dahlgren had been previously sunk by the Indiana she therefore did not sink the Kearsarge, and that as the Kearsarge considered herself sunk by the Dahlgren, therefore the successful attacks of the Porter and the Holland did not count. There is no question, and none was ever raised, that three successful attacks on the Kearsarge were made almost simultaneously by these three boats, and under every rule of justice she should have been declared sunk, as her commanding officer thought her to be, but the Indiana-Dahlgren controversy was allowed to render invalid the just claims of the Porter and Holland.

These operations for the moment disposed of three out of the five ships of the blockading force, during which manœuvres and prior to the attempts on the Kearsarge above related, the Gwin and another boat were put out of action, I believe, by the Kearsarge. The Dahlgren supposed she had put out the Indiana, but nothing more was seen of that vessel by any one until after the time limit expired.

After leaving the Kearsarge, an effort was made by the Porter to find the Indiana and Texas, and we are confident at its end that neither of these vessels was in such a position as to cover Newport harbor. The Fall River boat, a blaze of light, came out of Newport just after the Kearsarge incident, and the Porter steamed out to sea on a course parallel to hers and about four miles east of her, knowing that if there were a battleship anywhere between the steamer and herself an eclipse of the steamer's lights must ensue. There was no such eclipse, and after steaming down almost to Point Judith buoy that effort was given up.

Having but a half-hour left, the Porter steamed to the fairway, outside Brenton's Reef, and lay still in the channel, waiting for one of the two ships to come in, hoping they would do it before eleven o'clock. At about 10.40 the Texas was sighted heading directly for the Porter, and had time served we had but to lie still until she was within torpedo range, for, with the boat still in the water as she was, she was quite invisible, and the Texas was not using her search-lights.

However, the short time available prevented our doing this, so we steamed slowly towards her, and were just in position to make the rush when she struck six bells and turned on her running lights.

The net actual results of the night were three out of five ships sunk, with a loss of two out of five boats. The umpire's decision next day lost the Dahlgren and saved the Kearsarge. The two remaining ships of the blockading force had gone so far to sea as to render them of little value to the blockade.

It will doubtless be maintained that these results are arguments for the scattered search principle as against my own, but I believe that the single-boat attacks which succeeded here would have resulted in disaster in real service. The inner ships were to have sent in picket-boats, but the torpedo-boats got out before this was done and caught the inner ships unawares. This would hardly be done in warfare. And with proper pickets to designate the direction and time of approach of a boat I do not believe that a single boat would be able to get far, whereas the seven, scattering upon alarm by the pickets, would create such a flurry from so many directions, that success would be more than likely in spite of the pickets.

Like David Harum I am always willing to give the other fellow a show, and under these circumstances if I could trade off two or three boats for one battleship, I would be content to call it a good night's work and to leave the enemy a few stray vessels here and there for a future occasion, instead of devastating his entire fleet in one fatal attack by pitting single boats against single battleships.

The fact that the Dahlgren, Porter and Holland all tried for the Kearsarge at about the same moment looks at first blush like a support of the accidental concentration theory of Lieutenant Ellicott, but when the facts are all borne in mind I hardly believe this will be accepted as true. There were no pickets out, two of the blockaders had gone into port over an hour before as sunk, two others had gone so far away that there was no possibility of finding them within the time limit, with a result that the Kearsarge was left alone in her glory to bear the whole brunt of attack. Part of the boats had gone out to the westward and worked to the eastward, and the rest went out to the eastward and worked to the westward. That we three met the Kearsarge at the same time in the middle is no wonder, and proves nothing to me.

In other words, I claim that as far as torpedo work was concerned, these manœuvres gave us all some fine elementary instruction that we sadly needed, but that as far as proving or disproving any tactical theories was concerned they were of the very slightest value. If persisted in much will eventually be learned by such exercises, but to be of value absurd time limitations must be done away with, day-time drills must be abolished for the time being, the elements of fatigue and surprise must be allowed to play their full part, and all night work and all day sleep must be the rule. All hands on deck from eight to eleven and then "Hurrah for our hammocks" is a wonderfully poor assimilation to war conditions, and if we are to learn anything from manœuvres that cry must be done away with once and for all.

PROFESSIONAL NOTES.

Prepared by Lieutenant L. S. VAN DUZER, U. S. Navy.

SHIPS OF WAR, BUDGETS AND PERSONNEL.

AUSTRIA.

BUDGET.—The budget for 1901 amounts to 43,490,820 crowns ($8,828,636.46; 1 crown = $0.203). The ordinary charges are placed at 28,521,660 crowns ($5,789,896.98), an increase of 2,965,610 crowns as compared with 1900; while the extraordinary charges are 14,969,160 crowns ($3,038,739.48), an increase of 1,058,710 crowns. The ordinary charges include, in addition to other items, the following: Last instalment for the construction of the torpedo cruiser Aspern (ex-B), of 2350 tons; third instalment for torpedo cruiser Szigetvar (ex-C), of 2350 tons; second instalment for armored cruiser E, of 7400 tons, to replace the Radetzky; last instalment for small mine-tender of 200 tons; and first instalment for battleship A, of 10,000 tons, to replace the Laudon. The extraordinary charges include items for armaments and ammunition for ships building, mines, torpedoes, torpedo nets, coaling and mine stations, magazines, gun-cotton, etc., also the following: last instalment for the armored cruiser Kaiser Karl VI (ex-D), of 6250 tons; fourth instalment for the Habsburg (Battleship I), of 8340 tons; third instalment for battleship II, of 8340 tons; and second instalment for battleship III, of 8340 tons.

BATTLESHIP A.—The plans for this battleship are still under consideration and no details are yet given out. The displacement will be about 10,000 tons.

ARMORED CRUISER E: PRINCIPAL DETAILS.—This vessel will be of the Kaiser Karl VI type, but longer, and is reported to have been laid down in the latter part of 1900.

Armament—Two 24-cm. (9.45-inch) Krupp guns in turrets, one forward, one aft. Ten 15-cm. (5.9-inch) Skoda guns in casemates. Twenty-five smaller guns. Torpedo tubes.

Protection.—Belt, 8.7 inches. Turrets, 7.9 inches. Casemates, 5 inches.

Motive power.—Twin-screw, triple-expansion engines. Yarrow water-tube boilers. Designed I. H. P., 12,300, to give a speed of 21 knots.

Dimensions.—Length, 383.75 feet; beam, 61.66 feet; mean draft, 21.3 feet; displacement at this draft, 7400 tons (metric).

HABSBURG: LAUNCH, DESCRIPTION.—This second-class battleship was launched at the San Marco (San Rocco?) Yard of the Stabilimento Tecnico Triestino on September 9, 1900. She is the first of three sister ships now under construction. The hull is of steel without sheathing. Wood is used as little as practicable; the upper (over superstructure) and main decks are planked but the others are covered with linoleum or corticine. The poop and forecastle are both continuations of the main deck; between

them is a superstructure which is decked over and surrounded by bulwarks of good height. The freeboard at the stem is about 19 feet and at the stern about 18. There are two smokepipes and two military masts. Electricity will be used for lighting the ship; also for working the guns, ammunition hoists, ventilating machinery, etc. The electric plant will consist of 6 three-phase dynamos.

Armament.—Three 24-centimeter (9.45-inch), L. 40, Krupp guns of so-called R. F. type: two in a closed balanced turret forward and one in a similar turret aft. Twelve 15-cm. (5.9-inch), L. 40, Skoda guns: six each side in two-story casemates, the lower story on the gun deck, the upper one on the main deck in the superstructure. The four forward guns can fire directly ahead and the four after ones directly astern. Ten 6-pounders: four each side on the superstructure and one each side on the gun-deck forward. Twelve 1-pounders and eight machine guns. (It is not yet definitely settled whether the small guns will be as described or whether the 6-pdrs. and 1-pdrs. will be replaced by 24 3-pdrs.) The ammunition hoists are electric and lead directly from the guns to the magazines and shell rooms. Height of axes of guns above load water-line: forward turret guns, 25 feet; after turret guns, 24 feet; casemate guns on gun deck, 14.7 feet; casemate guns on main deck, 21.3 feet. All except the turret guns are furnished by the Skodawerke, Pilsen. The torpedo armament consists of two submerged tubes for 45-cm. Whitehead torpedoes.

Protection.—Belt, 8.7 inches thick, extending about two-thirds the length amidships and enclosing the bases of the barbette towers (or loading tubes—they are small for towers and very large to be styled loading tubes). The main belt extends to 4.3 feet below the load water-line and 3.5 feet above it. Beyond the belt, 2-inch armor of the same width extends to the stem, being widened at the extreme end, where it descends to cover the ram. Above the belt, 4-inch side armor of the same length extends to the gun deck. The ends of the belt and side armor are joined by vertical bulkheads rising from the protective deck. The latter is 2.3 inches thick forward of the belt and 2.6 inches abaft it; the middle protective deck is flat, resting on top of the belt, and is 1.8 inches thick. The turrets for the heavy guns are 8.4 inches thick with 7.2-inch barbette towers. The casemates are 5.4 inches thick on the outboard sides and 3.5 inches on the inboard. The forward conning-tower is 8 inches thick with 6-inch communication tube; the after one is 4 inches, with a 2-inch tube. The armor is of chrome-nickel-steel, face-hardened by the makers' own special process, and is furnished by Witkowitz and Company, who have supplied all the recent armor for the Austrian Navy.

Motive power.—Twin-screw engines of 11,900 (estimated) I. H. P., designed to give 136 revolutions and a speed of 18.5 knots. Boilers, 16 Belleville. Coal capacity, 840 tons.

Dimensions.—Length, 354.25 feet; beam, 65.6 feet; draft, 23.3 feet; displacement at this draft, 8340 tons (metric).

The other two battleships of the Habsburg type are under construction, one at the government yard at Pola and the other, like the Habsburg, at Trieste.

SZIGETVAR: LAUNCH, DESCRIPTION.—This vessel is called a torpedo cruiser and is, in all essential respects, a sister ship to the Zenta and Aspern. The main deck is flush without superstructure, or raised poop, or forecastle. There are two light pole masts and two smokepipes. The hull is of steel, sheathed and coppered.

Armament.—Eight 4.7-inch Skoda guns: two on the main deck, one forward and one aft; six in broadside on the gun deck, three each side, the forward and after pairs in sponsons and capable of firing directly ahead and astern, respectively. Ten 3-pounders: three each side on the gun deck and four on the main deck, one over each sponson. Two machine guns. Two 17.7-inch torpedo tubes.

Protection.—Complete protective deck, 1.96 inches thick on the slope and 1.2 inches on the flat.

Motive power.—Twin-screw, vertical, 4-cylinder, triple-expansion engines and eight Yarrow water-tube boilers. The estimated I. H. P. with natural draft is 5000 and with forced draft 7000; the corresponding speeds being 17.5 and 20 knots. The coal capacity is 475 tons and the anticipated radius of action about 4000 miles at 10 to 12 knots.

Dimensions.—Length between perpendiculars, 302.8 feet; over all, 315.9 feet; beam, 39.4 feet; mean draft, 14.1 feet; displacement at this draft, 2350 tons (metric).

BRAZIL.

PERSONNEL.—A recent law of the republic has fixed the numbers of the various lists of effectives in time of peace. No change is made in the officers. The number of midshipmen and cadets is not to exceed 180; the number of enlisted men is fixed at 4700 and of apprentices at 1500, while the marine infantry will have 450 men. In time of war these numbers as well as those of all the other lists will be doubled.

DENMARK.

BUDGET FOR 1901.—According to the *Rivista Marittima* the Danish naval budget amounts, in the ordinary items, to 6,851,449 crowns ($1,836,188.37; 1 crown = $0.268) and in the extraordinary items to 214,000 crowns ($57,352). In the ordinary expenses, the sum of 5,164,469 crowns ($1,384,077.69) is for the navy proper and 1,586,980 crowns ($425,310.64) is for the expenses of the ministry of marine, dependent offices, schools, etc. There is an error of 100,000 crowns in these figures, probably typographical, but it is not possible to locate it with the information at hand. The expenses for the navy proper (apparently including the extraordinary charges) are divided up as follows: Ministry, 91,434 cr.; pay, 792,398 cr.; dockyard expenses, including material, 2,856,252 cr.; provisions, 40,134 cr.; sanitary service, 48,600 cr.; clothing, 62,917 cr.; barracks, 123,293 cr.; improvement of harbors, 35,000 cr.; schools of instruction, 116,308 cr.; equipment of ships, 1,002,400 cr.; miscellaneous, 93,228 cr.; pensions, 1146 cr.; hydrography, 32,390 cr.; school for enlisted men, 120 cr.; rent of quarters, 131,061 cr. Again we find a discrepancy of figures but they are sufficiently close for our purpose, which is to give a good idea of Danish naval affairs. Of the sum allotted to dockyard expenses, new construction accounts for 1,215,000 crowns, with which it is expected to continue the construction of the little battleship Herluf Trolle and of the mine boat Beskytteren; to commence another vessel of the Herluf Trolle class; to thoroughly repair and refit the armorclad Tordenskjold, the royal yacht Dannebrog, and the gunboat Guldborgsund. The extraordinary vote comprises 99,000 crowns for material "di sbarramento," 100,000 crowns for fitting out the Herluf Trolle, and 15,000 crowns for fitting out the Beskytteren.

FRANCE.

BUDGET AND PROGRAM FOR 1901-1907.—On February 6, the French Senate approved in its entirety the French naval budget which had already passed the Chamber of Deputies. The budget was approved by sections and much of it had been assented to some time before. On December 9, President Loubet promulgated the following law which formed a part of the budget:

"Art. 1.—The Minister of Marine is authorized to construct in the government yards, or by contract in private establishments, the ships hereinafter designated, of which the total cost is estimated at 526,836,000 francs ($101,679,348; 1 franc = $0.193):

6 battleships of 14,865 tons;

5 armored cruisers of 12,600 tons;

28 torpedo-boat destroyers of about 305 tons.

"In addition to these, there are authorized torpedo boats, submarine boats, and submergible boats, of which the number will be determined later; and of which the total cost is estimated to reach 118,300,000 francs ($22,831,900).

"Art. 2.—The credits relative to new construction provided in the budget for 1900, or authorized by the present law, are 762,212,000 francs ($147,106,916) and are to be expended before January 1, 1907."

This will be provided for each year in the ordinary expenditures.

"Art. 3.—The credits, or portions of credits, remaining unused at the end of any year will, before March 31 of the second year, be carried forward to the credit of the following budget."

The program herein outlined is to be completed by January 1, 1907; and the amounts to be spent each year are approximately as follows: 1901, 111 millions; 1902, 117 millions; 1903, 127 millions; 1904, 127 millions; 1905, 104 millions; 1906, 69 millions.

In accordance with this program it is expected that the following new construction will be commenced in 1901:

Two battleships of 14,865 tons; one at the arsenal at Brest and one in a private yard.

Ten torpedo-boat destroyers of the Fauconneau type (303 tons, 26 knots); two at the government yard, Rochefort, and eight in private yards.

Twelve first-class torpedo boats: one at the arsenal, Saigon, and eleven in private yards.

Eight submarine boats of improved Narval type; two at the arsenal, Cherbourg; six at the arsenal, Toulon. The length will be 34 meters; beam, 3.75 meters; displacement, 106 tons. This will make twenty submarine boats building or completed.

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks; date of completion.
New battleship	14,865	At a private yard.	Not yet ordered.
"	14,865	Arsenal, Brest.	To be laid down.
Suffren	12,728	"	Launched; compl. 1902.
Iena	13,052	"	Having trials; compl. 1901.
Henri IV	8,948	Arsenal, Cherbourg.	Launched; compl. 1902.
Armored Cruisers.			
Jules Ferry	12,550	Arsenal, Cherbourg.	Ordered; keel not laid.
Leon Gambetta.....	12,550	Arsenal, Brest.	Ordered; keel not laid, but to be laid soon; to be launched end of 1901.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks; date of completion.
New ship	12,550	Arsenal, Toulon.	To be laid down this year.
Jeanne d'Arc	11,270	"	Lchd.; to be compl. 1901.
Gloire	10,000	Arsenal, Lorient.	Launched June 27, 1900.
Marseillaise	10,000	Arsenal, Brest.	Launched July 14, 1900.
Amiral Aube	10,000	Ch. de la Loire, St. Nazaire.	Not launched; compl. 1903.
Sully	10,600	Forge et Chantiers de la Mediterranée, La Seyne.	" "
Condé	10,000	Arsenal, Lorient.	Laid down Jan. 1, 1901.
Amiral Gueydon	9,516	"	Compl. this year possibly.
Dupetit Thouars	9,516	Arsenal, Toulon.	To be launched 1901.
Montcalm	9,516	F. et C. de la M., La Seyne.	Launched; compl. 1901.
Desaix	7,700	Ch. de la L., St. Nazaire.	To be launched soon.
Dupleix	7,700	Arsenal, Rochefort.	Lchd.; compl. Oct. 1902.
Kléber	7,700	Ateliers de la Gironde, Bordeaux.	Not launched; compl. 1903.
Protected Cruisers.			
Chateaurenault	8,018	F. et C. de la M., La Seyne.	Not yet delivered to govt.
Jurien de la Gravière	5,500	Arsenal, Lorient.	Launched; compl. 1901.
Transport.			
Vaucluse	1,650	Arsenal, Rochefort.	Building; compl. 1901.
Torpedo Boat Destroyers.			
Pertuisane	303	Arsenal, Rochefort.	Launched.
Escopette	303	"	"
Flamberge	303	"	Just begun.
Rapière	303	"	"
Sarbacane	303	"	Ordered; not yet begun.
Carabine	303	"	" "
Arquebuse	303	A. Normand et Cie., Havre.	Compl. 1903.
Arbalete	303	"	"
Mousquet	303	"	"
Sagaie	303	"	"
Epieu	303	"	"
Harpon	303	"	"
Fronde	303	"	"
Javeline	303	"	"
Torpedo Boats.			
Trombe	185	Ch. de la Loire, Nantes.	Compl. 1901.
Sirocco	185	A. Normand et Cie., Havre.	"
Mistral	185	"	"
Simoun	185	F. et C. de la M., Havre.	"
Typhon	185	"	"
Bourrasque	150	A. Normand et Cie., Havre.	"
Raffale	150	"	"
Nos. 22 and 224	84	Arsenal, Cherbourg.	
Nos. 258, 259, 260, 261	90	Ateliers de la G., Bordeaux.	Compl. 1901-1902.
Nos. 243, 253, 254, 255, 256, 257	86 to 90	F. et C. de la M., Havre.	
Nos. 264, 265	90 (?)	Société Dyle et Bacalan, Bordeaux.	Compl. April, 1902.
Nos. 225, 226	84	Arsenal, Toulon.	Begun 1898; compl. 1901.
Nos. 245, 246, 247, 248, 249, 250, 261, 262, 263	86 to 90	Creusot Works, Chalons-sur-Saone.	Some nearly compl. etc.
No. 244	90	Arsenal, Saigon.	Compl. Jan. 15, 1902.
P96	?	"	Compl. 1903.
1 New first-class boat	?	"	To be laid down.
11 " "	?	In private yards.	Not yet ordered.

NEW BATTLESHIPS: DESCRIPTION.—These vessels will be more fully described in a later number of the PROCEEDINGS. The complement will be 42 officers and 751 men. The principal features are:

Armament.—Four 12-inch guns in pairs in balanced turrets forward and aft. Eighteen 6.48-inch guns: twelve in pairs in turrets; six in casemates. Twenty-six 3-pounders. Two 1-pounders. Five torpedo tubes, of which two are to be submerged.

Protection.—Complete belt, 12 inches thick at the water-line amidships. Above this a thinner belt, also complete, and 4 inches thick, rising to a height of 8.2 feet above the water at normal load. Complete protective deck 4 inches thick on the slopes. Main turrets, 11 to 12.5 inches thick.

Motive power.—Triple-screw, triple-expansion engines of 14,475 I. H. P. Designed speed, 18 knots. Normal coal supply, 905 tons; total coal capacity, 1825 tons.

Dimensions.—Length, 438.9 feet; beam, 79.5 feet; draft, aft, 27.5 feet; displacement, 14,865 tons (metric).

CONDÉ: KEEL LAID, DESCRIPTION.—The keel of this armored cruiser was laid at Lorient arsenal on New Years day, 1901. All of her sisters were begun some months before and two, the Gloire and Marseillaise, have been launched. The hull is of steel, without sheathing. There are four smokepipes; one military mast forward with two tops; signal mast aft with one small top. The upper deck extends nearly to the stern so that the after turret is at the same height as the forward one. The complement is 23 officers and 540 men. The principal details are:

Armament.—Two 7.6-inch guns in turrets, one forward, one aft. Eight 6.48-inch guns: four in turrets on the upper deck, two each side amidships, about 60 feet apart; four, singly in casemates, one sponsoned out each side on the main deck abreast forward smokepipe, giving fire directly ahead, and one each side on berth deck abreast mainmast, giving fire directly astern by recessing the port. Six 3.9-inch guns: two on upper deck in forward superstructure and above forward pair of 6.48-inch guns, with fire directly ahead; two on main deck above after 6.48-inch casemates with fire directly astern; two on main deck amidships between bases of 6.48-inch turrets. Eighteen 3-pounders: four in the tops, four on each side on berth deck amidships, one each side on main deck forward, and the rest on the upper decks and bridges. Six 1-pounders. Two 2.56-inch boat and field guns. Two 17.7-inch torpedo tubes. Six searchlights: one each side in ports near the stern, one each side in ports near stem, one at foremasthead, and one on low platform on mainmast.

Protection.—The water-line armor belt extends from the stem nearly to the stern. It is 6.7 inches thick amidships, 4.2 inches at the bow and 3.8 inches at the after ends, which are joined by a transverse bulkhead, 3.9 inches thick. This belt extends 9.8 feet above water forward, 7.55 feet amidships, and 8.2 feet aft. The lower edge is 4.9 feet under water throughout. Above this belt the side armor forward, 2.2 inches thick, extends to the main deck and is continued from the stem to a point a little abaft the forward 6.48-inch guns. There are two protective decks. The lower one, with its flat at the level of the water-line, inclines downward at the sides to meet the lower edge of the main belt. The upper, or splinter deck, is flat and rests on the top of the belt. The lower protective deck is 1.77 inches thick. The upper one is 1.2 inches amidships, decreasing to 0.8 inch forward. The space between the protective decks is divided by four longitudinal bulkheads. The outer division,

between the outer bulkhead and the side, is the cofferdam and is divided into numerous compartments. Inside this is a wing passage for ammunition, etc. The central section is also subdivided. The smokepipe bases, ammunition hoists, etc., as they pass through it are protected by armor surrounding each. The 7.6-inch turrets and their bases are 7.9 inches thick; the turrets of the 6.48-inch guns, 4.72 inches; casemates for the after 6.48-inch guns are closed on the after side by a transverse bulkhead 4.72 inches thick; the casemates for the forward guns have a similar bulkhead on the forward side; the fronts of all the casemates are 4.7 inches thick and a thick shield on the gun closes the port against entry of projectiles. The 3.9-inch guns have shields in two parts, one fixed and one turning with the gun. There are two conning-towers, the forward one 7.9 inches thick and the after one 6.3 inches.

Motive power.—Triple-screw, triple-expansion engines of 20,500 I. H. P. Twenty-eight Niclausse boilers: six each in the two end compartments and eight in each of the others. Total number of elements, 352, 18 tubes in each; total grate surface 118.4 square feet; total heating surface, 39,904.15 square feet; total weight, including fuel and water in boilers, 369 tons. The coal supply is 970 tons; in addition to which tanks are fitted to carry 80 tons of petroleum.

Dimensions.—Length, 452.6 feet; beam, 66.3 feet; draft, 24.8 feet; displacement at this draft, 10,014 tons.

PERTUISANE, ESCOPETTE: LAUNCH, DESCRIPTION.—These two torpedo-boat destroyers, of the Fauconneau type, were launched at the government yard, Rochefort; the Pertuisane on December 5, 1900, and the Escopette on December 20. Their armament consists of two torpedo tubes; one 2.56-inch gun forward; and six 3-pounders, three each side. The designed horsepower of the machinery is 5700, and the expected speed is 27 knots. The coal capacity is 38 tons. The dimensions are: Length, 183.7 feet; beam, 19.48 feet; extreme draft, 10 feet; displacement, 303 tons. Complement, 4 officers and 44 men.

AUDACIEUX: TRIAL SPEED, DESCRIPTION.—The full power trial of this "armored" torpedo boat took place early in February. The speed obtained was 26.2 knots, 0.2 of a knot above the requirement of the contract. The Audacieux, and a sister boat, the Trombe, were built at the yard of the Ateliers et Chantiers de la Loire, Nantes. The Trombe is undergoing repairs due to an accident while having preliminary trials.

The armament of these boats consists of three torpedo tubes and two 3-pounders. An electric searchlight of 15.7 inches diameter is carried. The two compartments which contain the boilers and engines are covered on the sides and bulkheads with nickel-steel plates 0.95-inch thick. The deck over the boilers, engines, servo-motor, etc., is also armored—0.95-inch on the vertical and sloping parts and 0.35-inch on the horizontal parts. The machinery is designed to develop 4200 I. H. P. and give a speed of 26 knots. The coal capacity is 18 tons. The dimensions are: length, 177.6 feet; beam, 16.9 feet; extreme draft, 6.2 feet; displacement, 185 tons.

FRANÇAIS: LAUNCH, PARTIAL DESCRIPTION.—The submarine boat Français was launched at Cherbourg arsenal on January 25. She is a sister to the Algérien and was designed by M. Romazotti. These boats are of the Morse type with certain changes and improvements which have slightly increased the displacement. The hull is of steel, driven when submerged by electricity. The complement is one officer and eight men.

The trials of the boat are now in progress. The anticipated speed when running on the surface is 13 knots; and when submerged it is hoped that it will reach 8 knots. The radius of action is about 200 miles. The dimensions are: Length, 118.1 feet; beam and outside depth of hull, 9.18 feet; displacement submerged, 146 tons.

MORSE AND NARVAL: TRIALS.—The trials of French submarine boats have so far resulted in the victory of the Morse, which is of the true submarine type, over the submergible Narval. The Morse is similar in general features to the Holland but has only 2.5 tons buoyancy when at the surface, so that only a very small part of her 141 tons of hull is above water. Being driven by petroleum motors at all times (so stated by French papers), there is no change of motive power for submerging and she is able to accomplish it in two minutes after opening the valves to the tanks. She has then a slight negative buoyancy which is overcome by means of fins, or "ailettes" on each side. Should the pumps fail, she can at once be brought to the surface by detaching the lead ballast on the keel. The Narval is very different. She has wall sides and a flat deck and, when steaming on the surface, is like a low torpedo boat. To submerge her the motive power has to be changed, the smokepipe drawn in, and sufficient time must be allowed for the unused steam to cool down (so the reports say, but I doubt if steam is used), and a much larger quantity of water has to be admitted to the tanks than is the case with the Morse. At present the operation of submerging takes fifteen minutes and this is better than was done at the first trials. The new boats of this type are expected to submerge themselves in a little more than half this time. The Narval was to have been fitted with petroleum engines, but all the late reports say she is delayed in sinking by having to wait for the unused steam to cool down; if this is so, the plans must have been changed. When submerged she is propelled by storage batteries which she charges herself when running at the surface. In the trials recently made at Cherbourg the Morse submerged much quicker, steered as well or better, preserved her depth with greater steadiness, and fired her torpedoes with greater ease and accuracy. The Narval is, however, thought to be capable of much improvement and has points of superiority which render it desirable to develop the type as far as possible.

DÉVASTATION: RECONSTRUCTION.—The Dévastation, rebuilding at the Brest arsenal, is well advanced towards completion. Her upper works were nearly all removed, partly to effect changes, partly to get in her new Belleville boilers. A cofferdam is being fitted on the lower deck and some of the old iron armor has been replaced by plates of less weight but equal resisting force. Part of the superstructure has been suppressed. The 12.6-inch and 9.4-inch guns have been removed and will be replaced by six 10.8-inch. The changes will lighten the ship by about 200 tons and raise the upper edge of her belt about 4 inches higher out of water.

NEPTUNE, DUPERRÉ: RECONSTRUCTION.—These vessels will shortly be taken in hand at Brest for reconstruction. The estimated cost is $300,000 each. The superstructure of the Neptune will be reduced; also the masts. Belleville boilers will replace her present cylindrical ones; and the engines will be put in thorough repair and adapted to the new boiler pressure. The Duperré will also receive new boilers and her hull and engines will be repaired. The midship 13.4-inch. gun and fittings will be removed and replaced by four 6.48 guns in an armored casemate.

REQUIN: RECONSTRUCTION.—This old coast-defense ship has been in hand for a long time and the work is proceeding slowly, but she will probably be finished this year. The belt armor was very thick—19.5 inches, and it has been reduced in thickness in parts and otherwise lightened. The 16.5-inch guns have been removed and one 10.8-inch gun of later type placed in a closed turret, 9 inches thick, over each barbette. The engines have been thoroughly repaired and Niclausse boilers substituted for the old cylindrical ones. The total reduction in weights is about 600 tons, and it is expected that this will bring the upper edge of the belt (which was totally submerged at full load) well above water.

FURIEUX: RECONSTRUCTION.—The work on the Furieux, which is a much smaller ship, will be similar to that done on the Requin. The two 13.4-inch guns in barbettes will be replaced by two 9.4-inch guns of recent model in pairs in closed turrets. The engines will be repaired and Belleville boilers will replace the old cylindrical ones. The total lightening of the ship is estimated at 246 tons.

MARCEAU: RECONSTRUCTION.—The rebuilding of the Marceau is under way at the Toulon arsenal. The changes to be effected are similar to those to be made in the Neptune, already described.

GERMANY.

BUDGET FOR 1901.—The German naval budget for 1901 is fixed at 79,831,422 marks ($18,999,878.44—1 mark = $0.238) for the ordinary expenditure and 120,986,150 marks ($28,794,703.70) for the extraordinary; the total contemplated expenditure being 200,817,572 marks ($47,794,582.14). The extraordinary vote, following out the provisions of the German Naval Law, contains the following allotments for new construction and the rebuilding of existing ships: 1. For the battleships H and I, 6,000,000 marks. 2. For an armored cruiser to replace the Konig Wilhelm, 2,400,000 marks. 3. For three small cruisers, G, H and I (one of which is additional, the others in place of old ships), 3,900,000 marks. 4. For the construction of a division of torpedo boats, 2,400,000 marks. 5. For lengthening and rebuilding vessels of the Siegfried class, 4,500,000 marks; also 500,000 marks for their armament and equipment. The sum of 74,800,000 marks is allotted for vessels now under construction; and 1,000,000 marks to commence work on a third entrance to the port of Wilhelmshaven, the total cost of which is estimated at 30,000,000 marks. The German Navy League has placed at the emperor's disposal a certain amount from the reserve funds to be spent on work abroad. When the assent of the Reichstag is obtained, a river gunboat for service in China and the East will be ordered.

VESSELS BUILDING.

Name.	Displacement (tons).	Where Building.	Remarks; when compl.
Battleships.			
Wittelsbach	12,000	Govt. Yd., Wilhelmshavn.	Launched July 3, 1900.
D	12,000	Schichau, Dantzic.	Will be launched 1901.
E	12,000	Germania Yard, Kiel.	"
F	12,000	Vulcan Yard, Stettin.	"
G	12,000	Govt. Yd., Wilhelmshavn.	Keel laid Dec. 1, 1900.
H	?	?	Not yet ordered.
I	?	?	"
Kaiser Wilhelm der Grosse	11,130	Germania Yard, Kiel.	Lchd. 1899, compl. 1901.
Kaiser Karl der Grosse	11,130	Blohm & Voss, Hamburg.	Delayed by strike.
Kaiser Barbarossa	11,130	Schichau, Dantzic.	Lchd. April 21, 1900.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where Building.	Remarks; when compl.
Armored Cruisers.			
Ersatz Konig Wilhelm	?	?	Not yet ordered.
Prinz Heinrich	8,868	Government Yard, Kiel.	Launched March, 1900.
B	8,868	"	To be launched 1901.
Protected Cruisers.			
Nymphe	2,645	Germania Yard, Kiel.	Practically complete.
Niobe	2,645	Weser Yard, Bremen.	"
Thetis	2,645	Govt. Yard, Dantzic.	Fitting out.
Ariadne	2,645	Weser Yard, Bremen.	"
Amazone	2,645	Germania Yard, Kiel.	Launched Oct. 6, 1900.
E	2,645	Govt. Yard, Dantzic.	Building.
G	?	?	Not yet ordered.
H	?	?	"
I	?	?	"
Gunboat.			
A	899	Govt. Yard, Dantzic.	Building.
Torpedo Boat Destroyers.			
S_{90} to S_{97} (8 boats)	350	Schichau, Dantzic.	Bldg.; mostly compl.
S_{98} to S_{105} (8 boats)	350	"	Nearly all launched.
S_{106} to S_{113} (8 boats)	350	"	New program.

NEW BATTLESHIPS H AND I.—These vessels will not be sister ships to the Wittelsbach but of a new and larger type. The particulars are not yet published but the rumors are that they will carry Krupp's new 28-centimeter (11.02-inch) rapid-firing gun instead of the 24-centimeter piece; and also more than eighteen 6-inch, or else a dozen or more 8-inch. It is believed that no change will be made in the amount of protection or speed; but of course the displacement will be much increased.

BATTLESHIP G: KEEL LAID, DESCRIPTION.—The keel of this ship was laid at the government yard, Wilhelmshaven, December 1, 1900. She is a sister ship to the Wittelsbach and D, E, and F; and, if rumor is to be believed, is the last of this class to be built. Unlike the Kaiser Wilhelm II class, the superstructure is not carried to the bow so that the forecastle is at the level of the main deck. The superstructure is double-decked, making the ship very much higher amidships than the vessels of the Kaiser class. There are two military masts with tops rather low down and with searchlight platforms at the lower masthead. The smoke-pipes are large and two in number. The bow is of pronounced ram shape but does not recurve at the upper end of the stem like most recent German ships. The principal details are:

Armament.—Four 9.4-inch guns in balanced turrets over barbette towers forward and aft on the main deck. Eighteen 5.9-inch guns: eight on the gun deck amidships, four in a long armored casemate on each side, the forward guns firing directly ahead and the after guns directly astern; two in armored casemates on the main deck forward underneath the muzzles of the forward 9.4-inch guns; two in armored casemates, one each side on the gun deck just forward of the after 9.4-inch barbette tower, with fire directly astern; four in four small turrets on the main deck directly over the long central casemate, forward guns firing directly ahead and after guns directly astern; one each side on main deck in forward corners of superstructure, firing directly ahead. Sixteen 3.46-inch guns: four in forward end of upper superstructure, firing directly ahead; four in after end of upper superstructure with stern fire; two each

side in the upper superstructure, in an angle jutting out each side amidships, forward pair firing directly ahead and the after pair directly astern; and four on the forward end of upper superstructure, the forward pair of which is probably able to fire directly ahead. Twelve 1-pounders. Eight machine guns. Five submerged torpedo tubes: one in the keel about 25 feet from the ram, one each side abreast the forward 9.4-inch turret, and one each side beneath the center of the long casemate. The axes of the forward 9.4-inch guns are 30 feet above water and of the after pair about 21.5 feet.

Protection.—Complete water-line belt, 9.45 inches thick amidships, tapering to 8 inches abreast ends of superstructure, thence 5.9 inches to bow and stern. The turrets of the 9.45-inch guns are 10.6 inches thick and they rest on barbette towers about 9 feet high. From the bases of the barbettes a 10-inch loading tube extends to the protective deck. The turrets and casemates for the 5.9-inch guns are all 5.6 inches thick. The protective deck is curved, rising from the lower edge of the armor belt; for about one-third the length amidships the crown is about on a level with the upper edge of the belt, thence dropping gradually to the level of the lower edges of the belt at bow and stern. The turrets and isolated casemates of the 5.9-inch guns have armored loading tubes extending down to the protective deck, but the armor of the large midship casemate is carried down to the belt; while at its ends armored bulkheads extend across the ship from side to side and, like the faces of the casemates, the bulkheads are 5.6 inches.

Motive power.—Triple-screw engines designed to develop 15,000 I. H. P. and give a speed of 19 knots. Thorneycroft-Schultz water-tube boilers. The coal supply at load draft is 600 tons; total capacity, 1200 tons.

Dimensions.—Length between perpendiculars, 393.6 feet; beam, 68.2 feet; draft, 25 feet; displacement, 12,000 tons.

MEDUSA: LAUNCH.—This small protected cruiser of 2645 tons was launched at the yard of the Weser Company, Bremen, December 5, 1900. She is a sister ship to the Amazone, fully described in the PROCEEDINGS, No. 96, of December, 1900, page 703.

NIOBE, NYMPHE: TRIALS.—The *Marine Rundschau* gives some particulars of the trials of these cruisers, which are sister ships to the Medusa, except that the Niobe is sheathed and coppered. The Niobe's trials, which took place in July and August, 1900, are given in considerable detail. After preliminary runs to drill the engineer's force, the ship had five trials. One of 6 hours at full power; three of 24 hours, for coal consumption, at speeds of 11, 12 and 17 knots, and one of 72 hours at full speed with very moderate air-pressure in the fire-rooms. The particulars are as follows:

Duration, hours	6	24	24	24	72
Draft, mean, feet	15.66	15.73	15.68	15.81	15.81
I. H. P., main engines.....	8000	913	1204	3586	4852
Air pressure, inches	1.3	n. d.	n. d.	*	0.4
Revolutions	166.6	79.6	87.25	127.25	140.3
Speed, knots	21.6	11	12	17	19.45
Coal, per sq. ft. grate, lbs.		17.0	19	17.4	25.1
Coal, per I. H. P., lbs.....		2.41	2.13	1.86	2.01

* Blowers running but fire-rooms open.

The measured mile trials of the Niobe at different speeds gave the following results:

Speed.	I. H. P.	Revolutions.
21.594 knots	8511	166.4
17.048 knots	3505	126.73
11.979 knots	1183	87.09
11.189 knots	945	81.03

The results of the Nymphe's full power trial were: I. H. P., a little over 9000; revolutions, 158; speed 22.3 knots.

TORPEDO BOAT DESTROYERS S90 TO S113.—These boats are of about 350 tons displacement. The first division, S90 to S97, are all, or nearly all, completed. Of the division S98 to S105, nearly all will be launched by the time these notes are published. The division S106 to S113 are to be commenced this year. The second division, S98 to S105, are of the following dimensions: Length, 223 feet; beam, 21.3 feet; draft, 9.8 feet; displacement, 350 tons. The machinery is expected to develop 5400 I. H. P. with ease and give a speed of 26 knots on a long course. The boats of the other divisions are believed to be practically the same as these in design and dimensions.

HAGEN: RECONSTRUCTION, TRIAL.—The vessels of this class have proved a disappointment. They were designed as coast defenders and given a small coal capacity which has been found to be altogether too small. Furthermore they fell short of the designed speed of 16 knots by more than a knot and were, besides, deficient in stability. Radical measures to cure these ills were regarded as necessary and it was decided to experiment with the Hagen. She was cut in two and lengthened seven frame spaces (27.55 feet), increasing the length from 239.5 to 267 feet and improving her stability materially. At the same time Thorneycroft water-tube boilers, fitted for burning oil in conjunction with coal, were substituted for the old locomotive boilers. The single pole mast was removed and replaced by a military mast carrying a top with 37-millimeter machine guns. Two 3.4-inch guns were added to the battery; a flying bridge added between the forward and after bridges; the conning-tower more than doubled in thickness; and another smokepipe added, as the new boilers required two. The following is a comparison of the principal details before and after reconstruction:

	Before.	After.
Length between perpendiculars, feet	239.5	267
Breadth, extreme	48.97	49.07
Draft, mean, feet	17.46	17.46
Displacement, metric tons	3500	4114
Battery, 24-cm., 35 calibers	3	3
8.8-cm., 30 calibers	8	10
37-mm. machine guns	0	6
8-mm. machine guns	6	4
Torpedo tubes, 35-cm., bow, submerged	1	1 armored
35-cm., broadside, above water.	2	0
45-cm., broadside, submerged.	0	2
35-cm., stern, above water	1	0
45-cm., stern, above water	0	1
Conning-tower, thickness, inches	3.15	7.08
Masts	signal mast	military mast

	Before.	After.
I. H. P.	4545	5178
Boilers	4 locomotive	8 Thorneycroft.
Smokepipes	1	2
Coal supply, normal, metric tons	220	350
Coal capacity, metric tons	220	580
Complement	276	297
Turning circle at 12 knots, yards	400	430
Capacity of oil tanks, tons	0	1.7
Speed on trial, knots	14.85	15.1

The reconstruction of the Hagen is regarded as successful in all respects, and the other ships of the class will be similarly altered as soon as practicable.

PRINZESS WILHELM: RECONSTRUCTION.—This second-class protected cruiser of 4400 tons, launched in 1887, is to be modernized at Wilhelmshaven. The engines will be thoroughly repaired, new boilers supplied, a new protective deck fitted, and all woodwork removed and replaced by steel or non-inflammable material.

GREAT BRITAIN.

NAVAL ESTIMATES FOR 1901-1902.—The naval estimates for 1901-02 have been presented to parliament, but so far only telegraphic reports have reached this country. As full accounts will not be received until after this number of the PROCEEDINGS goes to press, the details of the new estimates will be given in No. 98. The total amount of the new estimates is £30,875,500 (£1 = $4.8665), an increase of over £2,000,000, chiefly for shipbuilding. The sum allotted to new construction is £9,003,256, of which £8,465,406 will be devoted to work in hand and the remainder for commencing new vessels. The vote for personnel includes provision for an increase of 9745 officers and men.

NEW PROGRAM.—The new program provides for three battleships, six armored cruisers, two third-class cruisers, ten torpedo-boat destroyers, five torpedo boats, two sloops of war, and five submarine boats. On some of these vessels work was begun in 1900. All the ships will be under construction before the end of this year. Under the heading of submarine boats, the First Lord says:

"Five of the type invented by Holland have been ordered, the first of which should be delivered next autumn. What the future value of these boats may be in naval warfare can only be a matter of conjecture. Experiments with these boats will assist the Admiralty in assessing their true value. The question of their employment must be studied in all its developments, and their mechanism carefully watched in this country."

SUPPLEMENTARY ESTIMATES FOR 1900-1901.—A supplementary estimate for naval services for the current financial year was issued this week. The additional number of men to be voted is 600, and the additional amount required £1,250,000. The votes affected by this estimate are: Vote 1. Wages, etc., of officers, etc., £500. Vote 2. Victualling and clothing, £84,000. Vote 8. Shipbuilding, etc., £935,500. Vote 11. Miscellaneous effective services, £230,000. Under the last-named heading are included the following estimates, for which no provision had previously been made: Hire of steam-vessels for communications in China, £18,500; expenditure in connection with the seizure and detention of vessels in

South African waters, £30,000; subsidy for use of South Australian gunboat Protector in Chinese waters, £2500; hire of distilling vessels during manœuvres, £9000; hire, etc., of steamship Ophir in connection with the visit of the Duke and Duchess of Cornwall and York to Australia, etc., £43,000. The effect of the supplementary estimate on the estimated expenditure for shipbuilding is to increase the sums allocated for new construction on dockyard-built ships by £29,160 and on contract-built ships by £207,000.—*Army and Navy Gazette*, London.

Instruction for Midshipmen and Cadets in Engine and Fire Rooms.—Orders have been issued that midshipmen and naval cadets are to be allowed to take advantage of ships being under way to keep watch in the engine and fire rooms of British ships, with a view to their steam instruction being of a more practical character than it has been in the past. With this end in view an engineer officer has now to assist the instructing lieutenant in the first instruction in seamanship, as well as the carpenter, who has hitherto given more time to the explanation of the lighter problems of ship construction.—*The Engineer*, London.

Naval Reserve Act of 1900.—This bill, passed just before the general election, empowers the Admiralty to raise a new division of the Royal Naval Reserve. This division is to be known as the Royal Fleet Reserve and regulations for its administration have been issued. It is to be composed of three classes: (*a*) Men in receipt of a long service pension for service as seamen, stokers, or marines; (*b*) Men who have served as seamen, stokers, or marines, but are not in receipt of a pension for such service; (*c*) Men employed as artisans or otherwise in any of the naval or civil establishments under the Admiralty, subject to a condition of service in the reserve. The first and third classes are not limited as to numbers, but the second class is limited to 15,000 men. Previously, reserves for the navy have been raised outside the service itself, but the present scheme is to raise a reserve from the navy and marines. So far as the seamen are concerned, the present scheme is an amplification of the present coastguard system, but the marine reserve is an entirely new body, and the arrangement to provide a reserve from the artisans who are trained in the dockyards is also new. In the course of time all seamen pensioners will become absorbed in the Royal Fleet Reserve, as, under the new rule, every man and boy joining the service after a certain date will be obliged to join this reserve as a condition of receiving a pension. Class B of this new reserve introduces a modified form of short service in the navy, and will probably rouse hostile criticism. Men who have completed a twelve years' engagement will be eligible, but service is entirely optional. The period of engagement is five years, but arrangements for further periods of the same length up to 55 years of age can be made.

Candidates for the new reserve must apply to the Commanders, R. N., at each of the three naval depots, and the staff officers, R. M., at Eastney, Chatham, Gosport and Plymouth, who are nominated as "Registrars," and are to be held responsible for the correct registration of the men attached to their corps, and for duties generally in connection with enrolment, re-enrolment, and service. The Admiralty will regulate the numbers to be entered annually in Class B, but apparently further instructions will be issued in connection with the entry of those men who have less than 12 years' service. In the case of others they may make application to their commanding officer for enrolment six months before

they complete their continuous service engagement, and if accepted they will be acquainted at once, and be entered in the Royal Fleet Reserve from the date of discharge from active service. Every man enrolled is to undergo a week's drill every year or a fortnight's drill every second year, at his own option, until attaining the age of fifty. This drill is to be carried out as a rule at the port of enrolment where special classes of instruction will be formed; for the seamen at the gunnery, torpedo or signal schools; for the stokers at the dockyard reserves and for the marines at headquarters. Full instructions are given on the subject of this drill, and the registrars are notified to be careful that all fleet reserve men fully understand the rules in this connection. As the payment of retaining fees and pensions depends upon putting in this drill within the prescribed period, this is important. In Classes B and C men will be liable up to the ages of 55 and 50 respectively to serve in the navy for three years when called out in emergency, but it may be extended by proclamation to five years. A man may claim his final discharge after five years' service from the date of being called out. Service in this reserve is to be naturally followed by an increase of pension or by the grant of pension to those not already receiving one.—*Marine Engineer*, London.

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks.
Battleships.			
Queen	15,000	Government Yard, Devonport.	Not yet commenced.
Prince of Wales	15,000	" Chatham.	"
Duncan	14,000	Thames Co., Blackwall.	To be lchd. March 21.
Cornwallis	14,000	" "	To be launched soon.
Exmouth	14,000	Laird, Birkenhead.	Not yet launched.
Russell	14,000	Palmer Co., Jarrow.	Launched Feb. 19, '01.
Albemarle	14,000	Government Yard, Chatham.	Launched Mar. 5, 1901.
Montagu	14,000	" Devonport.	"
London	15,000	" Portsmouth.	Compl. in autumn, '01.
Bulwark	15,000	" Devonport.	Launched June, 1901.
Venerable	15,000	" Chatham.	Lchd.; trials in 1901.
Formidable	15,000	" Portsmouth.	Compl. this summer.
Irresistible	15,000	" Chatham.	Nearly ready for trial.
Implacable	15,000	" Devonport.	Trials in progress.
Vengeance	12,950	Vickers, Barrow.	Launched.
Albion	12,950	Thames Co., Blackwall.	Trials in progress.
Glory	12,950	Laird, Birkenhead.	Has had trials.
Armored Cruisers.			
Drake	14,100	Government Yard, Pembroke.	Launched Mar. 5, 1901.
King Alfred	14,100	Vickers, Barrow.	Not yet launched.
Leviathan	14,100	J. Brown & Co., Clydebank.	"
Good Hope	14,100	Fairfield Co., Govan.	Launched Feb. 21, 1901.
Essex	9,800	Government Yard, Pembroke.	Not yet launched.
Kent	9,800	" Portsmouth.	Launched, Mar. 6, 1901.
Monmouth	9,800	London & Glasgow Co., Glasgow.	Not yet launched.
Bedford	9,800	Fairfield Co., Govan.	To be launched 1901.
Cornwall	9,800	Government Yard, Pembroke.	Ordered Nov. 1900.
Suffolk	9,800	" Portsmouth.	"
Berwick	9,800	Beardmore (ex-Napier), Glasgow.	"
Cumberland	9,800	London & Glasgow Co., Glasgow.	"
Lancaster	9,800	Armstrong, Elswick.	"
Donegal	9,800	Fairfield, Govan.	"

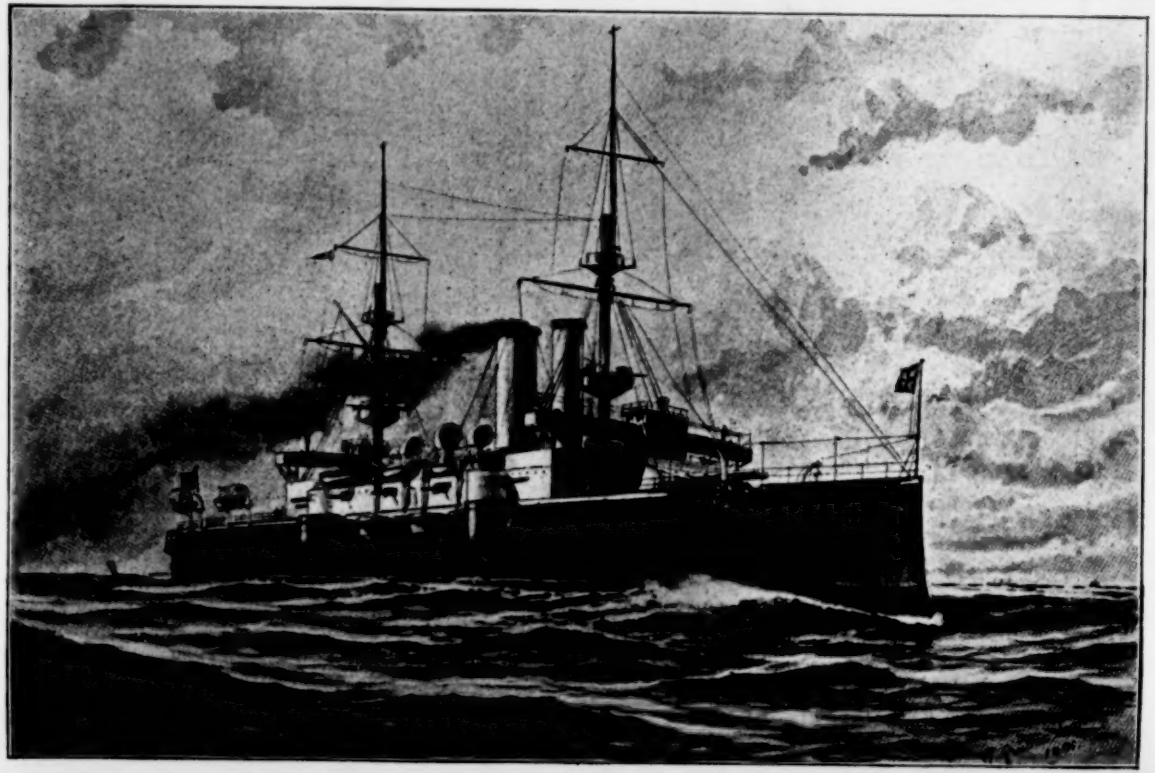
VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks.
Cressy.....	12,000	Fairfield, Govan.	Has had trials.
Aboukir.....	12,000	"	Launched; trials soon.
Hague.....	12,000	Vickers, Barrow.	"
Sutlej.....	12,000	J. Brown & Co., Clydebank.	"
Euryalus	12,000	Vickers, Barrow.	Not yet launched.
Bacchante.....	12,000	J. Brown & Co., Clydebank.	Launched Feb. 21, '01.
Protected Cruisers.			
Challenger.....	5,880	Government Yard, Chatham.	Ordered Nov., 1900.
Encounter.....	5,880	" Devonport.	"
Spartiate.....	11,000	" Pembroke.	Trials in progress.
Pandora	2,200	" Portsmouth.	"
Gunboats.			
Odin.....	1,070	Government Yard, Sheerness.	Ordered Nov., 1900.
Merlin	1,070	" "	"
Espiègle.....	1,075	" "	Building.
Fantome.....	1,075	" "	"
Mutine.....	980	Laird, Birkenhead.	Trials finished.
Rinaldo.....	980	"	Nearly ready for trial.
Torpedo-Boat Destroyers.			
Arab	320	J. Brown & Co., Clydebank.	Launched.
Falcon	355	Fairfield Co., Govan.	Had trials.
Greyhound	316	Hawthorn, L. & Co., Hebburn.	Launched Oct., 6.
Kangaroo.....	...	Palmer Co., Jarrow.	Trials in progress.
Lively.....	355	Laird, Birkenhead.	Launched.
Myrmidon	317	Palmer Co., Jarrow.	"
Ostrich.....	355	Fairfield Co., Govan.	Had trials.
Peterel.....	317	Palmer Co., Jarrow.	"
Racehorse	316	Hawthorn, Hebburn.	Launched Nov. 8.
Roebuck	316	"	Launched Jan. 4, 1901.
Sprightly	355	Laird, Birkenhead.	Launched.
Success	350	Doxford, Sunderland.	
Syren	317	Palmer, Jarrow.	Launched Dec. 20.
Torpedo Boats.			
Two boats.....	175	Thorneycroft, Chiswick.	Ordered.
No. 98.....	178	"	Launched Jan. 22, 1901.
No. 99.....	178	"	Launched Mar. 6, 1901.
Two other boats	178	"	Building.

CHALLENGER, ENCOUNTER: KEELS LAID.—The keels of these two new protected cruisers are to be laid this month (March), that of the former at Devonport and of the latter at Chatham. The displacement will be 5880 tons; I. H. P. of the machinery, 12,500; speed, 21 knots. Both vessels will have water-tube boilers; those of the Encounter, 18 in number, arranged in groups of six in separate fire rooms, will be of the Belleville type.

MERLIN, ODIN: LAID DOWN.—These gunboats of 1070 tons have been laid down at the government yard. Sheerness. The displacement will be 1070 tons; horsepower of machinery, 1400; speed, 13.25 knots. The hulls will be of steel sheathed with wood and coppered. Both will have water-tube boilers, those of the Merlin to be of the Niclausse type.

KHAKI, NUBIAN, DISTILLER, REPAIR SHIP: PURCHASED.—The London *Engineer* says that it is given to understand that the Admiralty has recently purchased two large steamers to serve as colliers for the navy;



H. M. S. RUSSELL, BUILT AND ENGINED BY PALMER'S SHIPBUILDING AND IRON COMPANY, LIMITED, JARROW-ON-TYNE.
From the Marine Engineer.

one of which, named the Khaki, will be attached to the Channel squadron, while the other, the Nubian, goes to the Cape of Good Hope station for the present. At the same time a large steamer was purchased, and will be equipped with machine tools, to act as a repairing ship; while a fourth vessel, to be known as the Distiller, will be fitted with an extensive plant for distilling water for the vessels of the fleet. These vessels will only be able to steam at what is known as the cruising speed of the fleets.

ALBEMARLE, RUSSELL, MONTAGU: LAUNCH, DESCRIPTION.—These first-class battleships were launched as follows: the Albemarle at the government yard, Chatham, March 5; the Montagu at the government yard, Devonport, March 5; the Russell at the works of the Palmer Shipbuilding Company, Jarrow-on-Tyne, February 19. The vessels of this class, six in number, are believed to be practically identical in design. The hull is of steel without sheathing and is divided into 320 water-tight compartments. The double-bottom extends about four-fifths the length amidships. There are two smokepipes on the fore and aft line, the after one much the larger; and two masts each carrying one military top and a searchlight platform, the latter at the lower masthead. Eighteen boats are carried, of which two are 56-foot steamers. They are handled by a 36-ton derrick on the mainmast and two 10-ton derricks on the foremast. The general plan of the upper works is similar to that of all recent British battleships. The ship has two conning-towers and can be fought from either. Six 25,000 c. p. searchlights are carried, and the ship is lighted by 900 incandescent lamps. The principal details are:

Armament.—Four 12-inch, 40-caliber, wirewound guns in pairs in turrets over barbette towers forward and aft, with arc of train of 120 degrees on each side of the keel. Twelve 6-inch guns: four each side on the gun-deck, in armored casemates, the forward and after pieces firing from directly ahead or astern to 30 degrees abaft or forward the beam; four on the main deck directly over the forward and after guns on the deck below, in similar casemates, and having the same arc of fire. Twelve 12-pounders: one each side on the gun deck well forward, and one on each side on the gun deck aft; three each side in the waist on the main deck between the 6-inch casemates; two, which are also boat and field guns, on the forward bridge deck. Eight Maxim machine guns. Six 3-pounders—three in each top. Four submerged torpedo tubes, two forward, two aft.

Protection.—The main belt, about fourteen feet wide, from 5 feet below water to the gun deck, is 7 inches thick and extends for a length of 286 feet from abreast the after barbette to within about 15 feet of the stem. Its after ends are joined to the after barbette by a curved bulkhead. Forward, the belt is continued to the bow by 2-inch armor laid over ordinary plating. This 2-inch armor extends down to the keel for ten or twelve feet abaft the ram but only rises to the berth deck. The middle deck is flat along the center line between the barbettes and is about 2.5 feet below water. This part is 1 inch thick. The sides drop (at an angle of about 40 degrees amidships) to meet the lower edge of the belt throughout its length. Beyond the barbette towers the central part gradually descends until it also is at the level of the lower edge of the belt. The sloping parts of this deck are 2 inches thick amidships, reduced to 1 inch at the ends. The gun deck, resting on top of the belt, is 1 inch thick. The lower deck, which acts as a splinter deck, is 1 inch thick amidships

and forward and 2 inches thick aft to afford extra protection to the steering-gear. The barbette towers for the 12-inch turrets are 11 inches thick except behind the belt armor where the thickness is reduced to 6 inches. The turrets are 8 to 10 inches. The forward conning-tower is 12 inches thick and of face-hardened armor, while the after one is 5 inches and of nickel steel.

Motive power.—Twin-screw, 4 cylinder, triple-expansion engines, with cylinders 33.5, 54.5, 63, and 63, inches in diameter and of 48 inches stroke. There are 24 Belleville boilers in three firerooms. Heating surface of boilers, 45,000 square feet; pressure of steam at boilers, 300 pounds; at engines, 250 pounds. Estimated total I. H. P. of machinery 18,000, designed to give a speed of 19 knots. The coal supply at load draft is 900 tons; total capacity, about 2000 tons; total number of coal bunkers, 52.

Dimensions.—Length between perpendiculars, 405 feet; beam, 75.5 feet; draft, 26.5 feet; displacement at this draft, 14,000 tons.

DRAKE, GOOD HOPE: LAUNCH.—These armored cruisers have been launched; the Drake at the government yard, Devonport, on March 5, and the Good Hope at the yard of the Fairfield Company, Govan, on February 21. A full description of these vessels will be given in the next number of the PROCEEDINGS.

BACCHANTE: LAUNCH, DESCRIPTION.—This armored cruiser of the Cressy class was launched at the works of Sir J. Brown & Company, Limited, Clydebank, on February 21. The others of the class are the Cressy, Aboukir, Hague, Sutlej, and Euryalus. All except the last-named are now launched. The hull is of steel, sheathed and coppered. There are four smokepipes on the fore and aft line, and two pole masts carrying searchlight platforms at the lower masthead. The freeboard is high for the greater part of the length as the superstructure extends from just forward the after turret to the stem. The topsides are cut away forward and aft to enable the forward and after 6-inch guns to fire parallel with the keel. For handling the boats there are two derricks on the foremast and one large one on the main. The principal details are:

Armament.—Two 9.2-inch guns in gun-houses over barbette towers, one forward, one aft. Twelve 6-inch guns: four each side on the gun deck in separate armored casemates, the forward and after pairs firing ahead and astern respectively; four in separate casemates on the main deck over the forward and after guns of the deck below and with similar arcs of fire. Twelve 12-pounders: four each side in the superstructure between the 6-inch guns; one each side in the superstructure well forward; and one each side on the gun deck well aft. Two 12-pounder boat and field guns are mounted on the after bridge deck. Three 3-pounders and eight machine guns on the decks and bridges. Two submerged torpedo tubes.

Protection.—The total weight of armor is about 1200 tons. The main belt, 6 inches thick and 11.5 feet deep (descending 5 feet below water and rising to the gun deck, 6.5 feet above it) extends for a length of about 230 feet amidships, terminating at 120 feet from the bow and 90 feet from the stern in 5-inch diagonal bulkheads extending in to the barbette towers. Forward of the belt 2-inch armor of the same depth extends to the stem, deepening slightly as it follows the edge of the protective deck until it reaches the point of the ram. The protective deck extends from stem to stern and it is 1.5 inches thick on the flat and 3 inches on the slopes. The flat amidships is about at the water-line, the sides sloping down to meet the lower edge of the belt. The barbette towers, fronts and sides

of gun-houses, and fronts of casemates, are all 6 inches thick. The inner walls of the casemates are 2 inches and the conning-tower 12 inches.

Motive power.—The engines are twin-screw, 4-cylinder, triple-expansion, with cylinders 36, 59, 68, and 68 inches in diameter and 48 inches stroke; and which, at 120 revolutions, are expected to develop 21,000 I. H. P. and give a speed of 21 knots. The boilers are 30 in number, of the Belleville type, arranged in four compartments, six in each forward one, and eight in each after one. The working steam pressure is 300 pounds at the boilers, reduced to 250 pounds at the engines. The coal supply at load draft is 800 tons; total capacity, 1600 tons.

Dimensions.—Length between perpendiculars, 440 feet; beam, 69.5 feet; mean draft, 26.25 feet; displacement at this draft, 12,000 tons.

KENT: LAUNCH.—The armored cruiser Kent, 9800 tons, was launched at the government yard, Portsmouth, March 6, 1901. The vessels of this class were fully described in PROCEEDINGS No. 96, page 696.

ESPIEGLE: LAUNCH, DESCRIPTION.—This gunboat, a sister to the Fantome, still on the stocks at the same yard, was launched at the government yard, Sheerness, December 7, 1900. The hull is of steel, sheathed and coppered. She has one smokepipe and a barquentine rig. The principal details are:

Armament.—Six 4-inch guns; four 3-pounders; two .45-cal. Maxim machine guns.

Motive power.—Twin-screw, triple-expansion engines, and Belleville boilers. Designed I. H. P., 1400; corresponding estimated speed, 13.25 knots. Coal capacity, 160 tons.

Dimensions.—Length between perpendiculars, 185 feet; beam, 33 feet; draft, 11.5 feet; displacement at this draft, 1075 tons.

CRESSY: TRIALS.—This armored cruiser is a sister ship to the Bacchante, already fully described. She had trials as follows, which were completed in December:

1. Thirty hours at one-fifth power on November 23 (draft forward, 25.5 feet; aft, 26.75 feet) gave: I. H. P., 4731; revolutions, 74; speed 13.89 knots. Head wind; sea moderate to rough.

2. Thirty hours at four-fifths power on November 29: I. H. P., starboard, 8141; port, 8129; total, 16,270; revolutions, starboard and port, 114.6; speed, 20.5 knots. Wind light and sea smooth.

3. Eight hours at full power on December 5: I. H. P., starboard, 10,473; port, 10,767; total, 21,200; average revolutions, 122; speed, 20.79 knots. Sea rough.

SEA TRIAL OF MEDITERRANEAN SQUADRON.—Some of the principal ships of this squadron took part in a trial or race, at four-fifths power, from a point six miles east of Gibraltar to another six miles north of Cape Figari, Sardinia, and 788 miles away. The results were:

Name of Ship.	Normal displacement.	Coal short on leaving Gibraltar.	Coal expended on trial.	Time occupied on trial.	Average speed per hour.
	tons.	tons.	tons.	h. m.	knots.
Ocean	12,950	110	518	46 54	16.8
Isis	5,600	65	264	47 12	16.7
Dido	5,600	30	303	48 30	16.25
Renown	12,350	441	354.3	49 6	16.03
Venus	5,600	25	329.75	49 16	15.99
Caesar	14,900	124.6	406.3	52 30	15.00
Victorious	14,900	809.35	455.3	52 36	14.98
Royal Sovereign	14,150	89	385	54 18	14.51
Royal Oak	14,150	95	509.5	55 10	14.3
Illustrious	14,900	116	469.9	55 20	14.25
Ramillies	14,150	98	337	55 22	14.22

SHEARWATER: FULL SPEED TRIAL.—This gunboat of 980 tons, a sister to the Mutine, Rinaldo, and others, completed her full speed trials satisfactorily. The results were: Steam at boilers, 226.8 pounds; steam at engines, 200.8 pounds; vacuum, 23.5 inches; revolutions, 194.2; I. H. P., h. p. cylinder, 430; intermediate cylinder, 461.3; low pressure cylinder, 541; total I. H. P., 1432.3; coal consumption reported as 1.57 pounds per I. H. P. per hour. Draft on trial, forward, 10 feet; aft, 13 feet.

MUTINE: TRIALS.—The trials of the gunboat Mutine, 980 tons, were completed in February. The results were:

1. Thirty hours at three-fourteenths power: Steam at boilers, 170.2 pounds; at engines, 168.4 pounds; vacuum, 27.15 inches; revolutions, 122.1; I. H. P., h. p. cylinder, 110.2; int. cyl., 84.1; l. p. cyl., 135.5; total, 329.8; speed, 8.1 knots; coal consumption, 1.87 pounds per I. H. P. per hour. Draft on trial, forward, 10.2 feet; aft, 13 feet.

2. Thirty hours at five-sevenths power: Steam at boilers, 198.7 pounds; at engines, 195.5 pounds; vacuum, 28.08 inches; revolutions, 181.3; I. H. P., h. p. cyl., 347.9; int. cyl., 291.9; l. p. cyl., 401.1; total, 1040.9 I. H. P.; speed, 12.2 knots; coal consumption per I. H. P. per hour, 1.72 pounds. Draft on trial, forward, 10.1 feet; aft, 12.9 feet.

3. Eight hours full power: Steam at boilers, 225.2 pounds; at engines, 215.6 pounds; air pressure, 0.17 inch; vacuum, 26.4 inches; revolutions, 206.5; mean pressure, h. p. cyl., 90.3; int. cyl., 31.1; l. p. cyl., 16.67; I. H. P., h. p. cyl., 483.9; int. cyl., 428.8; low, 577.9; total I. H. P., 1490.6; speed by patent log, 14.55 knots; speed on the measured mile, 13.74 knots; coal consumption, 1.63 pounds per I. H. P. per hour. The draft was practically the same as on preceding trials.

NEW TORPEDO BOATS ORDERED.—The two torpedo boats provided for in the budget of 1900-1901 have been ordered of Thorneycroft. The dimensions given by the *Journal of the Royal United Service Institution* are: Length, 160 feet; beam, 17 feet; mean draft, 5.75 feet; displacement, 175 tons. The horsepower of the engines is to be 2850; speed, 26 knots. Coal supply, 30 tons. Armament, three torpedo tubes and three 3-pounder guns.

GREYHOUND, RACEHORSE, ROEBUCK: LAUNCH, DESCRIPTION.—These torpedo-boat destroyers are building at the yard of Messrs. Hawthorn, Leslie & Co., Hebburn-on-Tyne. The Greyhound was launched on October 6; the Racehourse, November 8; and the Roebuck, January 4, 1901. They are alike in all respects and the dimensions are: Length, 210 feet; beam, 21 feet; depth, 12.5 feet; displacement, 316 tons. The armament will consist of one 12-pounder, five 6-pounders, and two deck torpedo tubes. The engines are designed to develop 6000 I. H. P. at 390 revolutions and give a speed of 30 knots. Four Yarrow boilers, in two separate compartments, supply steam at 250 pounds pressure.

SYREN: LAUNCH, DESCRIPTION.—The Syren is a sister to the Myrmidon and Peterel, already launched. These boats are all building at the yard of the Palmer Shipbuilding and Iron Company, Jarrow, where the Syren was launched December 20, 1900, and they are of the following dimensions: Length, 215 feet; beam, 20.75 feet; displacement, 317 tons. The armament consists of one 12-pounder, five 6-pounders, and two torpedo tubes on revolving platforms for firing on either side. Steam is supplied by four Reed boilers, and the guaranteed speed is 30 knots.

TORPEDO BOATS NO. 98 AND NO. 99: LAUNCH.—These boats are two of the four building by Thorneycroft for the British navy and were

launched at Chiswick on January 22 and March 6, respectively. The dimensions, according to the *Army and Navy Gazette*, are: Length, 155 feet; beam, 17 feet; draft aft, 8.4 feet; displacement (*Naval Annual*), 178 tons. The I. H. P. of the machinery is estimated at 2800 and the required speed is 25 knots. The armament will consist of three torpedo tubes and three 3-pounders.

LEE: TRIAL, DIMENSIONS, ETC.—This torpedo-boat destroyer, recently completed, has finished her trials successfully. The mean of four runs over the measured mile was 30.11 knots. The other details are: Draft of water forward, 5.37 feet; aft, 8.9 feet; steam pressure at boilers, 249 pounds; vacuum, starboard, 23.3; port, 23.1; revolutions, starboard, 380.7; port, 380.4; mean I. H. P., starboard, 3382; port, 3193; total, 6575. The reported dimensions of the Lee are not in agreement, but the following are probably correct, or nearly so: Length, 210 feet; beam, 21 feet; mean draught, 7.2 feet; displacement, 350 tons. She will carry the same armament as the Syren, Greyhound, etc.

MYRMIDON: TRIALS.—The Myrmidon is a sister ship to the Syren, already described, and was built by the Palmer Company at Jarrow. She had her preliminary trials on February 7 when the results were: I. H. P., 6623; revolutions, 379.5; speed, 30.13. On the official 3-hour trial, which took place February 12, the following results were obtained: I. H. P., 6303; revolutions, 377; speed, 30.23 knots. The mean of six runs over the measured mile was 30.52 knots.

SYBILLE: WRECKED.—The second-class protected cruiser Sybille, of 3400 tons and 19 knots speed, launched in 1890, was wrecked in Lambert Bay, Cape Colony, January 16, 1901. The ship is a total loss but the crew and officers were all saved.

GREECE.

NEW CONSTRUCTION PROPOSED.—A bill establishing a special fund for the increase of the navy was introduced into the Greek parliament, but has not, so far as can be learned, been passed. The measure is much criticised by the Athenian papers, some of which declare that no money will be voted for military expenditure while the army and navy are controlled by the persons principally responsible for the disasters of 1897.

ITALY.

ESTIMATES FOR 1901-1902.—The estimates of naval expenditure for 1901-02, presented by the Minister of Marine to the Italian parliament, have not yet been voted; or, at least, no report of this has so far reached the compiler. The estimates call for a total expenditure of 115,277,800 lire ($22,248,615.40—1 lira = $0.193), of which 11,540,646 lire is for the merchant marine and 1,374,540 lire for extraordinary expenses. The sum allotted to the navy is 2,868,451 lire in excess of that voted last year, while that for the merchant marine is 2,695,100 lire less.

NAVAL PROGRAM, 1901-1904.—The Minister of Marine has presented a bill providing that from 1901 to 1904 an extraordinary credit of eight million lire will be devoted to new construction in addition to the provisions of the ordinary budget. During these four years the sums allotted to new construction are: 24,500,000 lire for 1901, and 24,000,000 lire for the other three years. The number of permanent workmen in the government yards is not to exceed 12,000; in case of urgent necessity others may be taken on as temporary laborers.

PERSONNEL: LIST OF OFFICERS.—A new decree fixes the number of officers as follows: 1 admiral, 7 vice-admirals, 14 rear-admirals, 58 captains, 160 *enseignes de vaisseau*, and 110 midshipmen. The other lists remain as before.

VITTORIO EMANUELE III, REGINA ELENA: DESCRIPTION.—These two new battleships are to be laid down this year in government yards, the Vittorio Emanuele III at Spezia and the Regina Elena at Castellamare. These were designed as sister ships, though it is rumored that the Regina Elena will carry three 12-inch guns, have slightly less coal capacity, and differ a very little in dimensions. There are strong reasons for doubting the correctness of this rumor, but no official details are at hand to definitely contradict it. The particulars which are given below are those of the original design and they are certainly true for the Vittorio Emanuele III. These ships have very moderate freeboard aft—probably about 12 feet—and about 21 feet forward. The superstructure extends from the bow to a short distance forward of the after 12-inch turret; but it is only the full width of the ship for a short distance from the stem and between the forward and after 8-inch turrets. Elsewhere it is cut away to give emplacements for the 8-inch turrets, or to permit fire directly ahead from the forward 8-inch guns. There are three smokepipes and two pole masts without military tops. The principal details are:

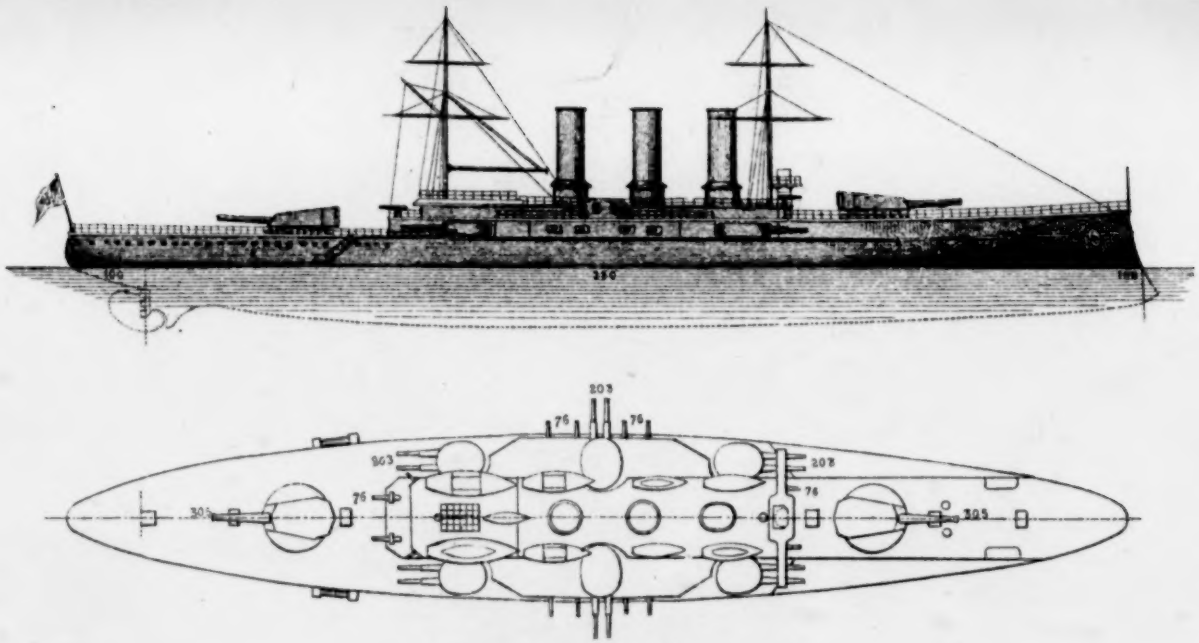
Armament.—Two 12-inch guns in turrets, one forward on the upper deck and one aft on the main deck. Twelve 8-inch guns in pairs in six turrets: two each side on main deck about 140 feet apart, and one each side on upper deck about halfway between the lower ones. Twelve 3-inch, of which eight are in the superstructure, four each side, between the 8-inch turrets. Twelve 3-pounders. Two above-water torpedo tubes, protected by armor, and two submerged tubes.

Protection.—Complete water-line belt 9.8 inches thick amidships and 3.9 inches at the ends. Side armor above belt, 5.9 inches. Thwartship bulkheads, 7.9 inches. Turrets of 12-inch guns, 6 inches; barbette towers, 7.9 inches. Turrets of 8-inch guns, 5.9 inches. Conning-tower, 9.8 inches. Signal tower, 1.96 inches. Protective deck, 2.9 inches on the slopes. All armor is to be Terni special, face-hardened.

Motive power.—Twin-screw engines. Water-tube boilers. Estimated I. H. P. of machinery, 20,000. Speed, 21.5 to 22 knots. Coal supply at load draft, 1000 tons; total capacity, 2000 tons. Radius of action, 10,000 miles at 10 knots.

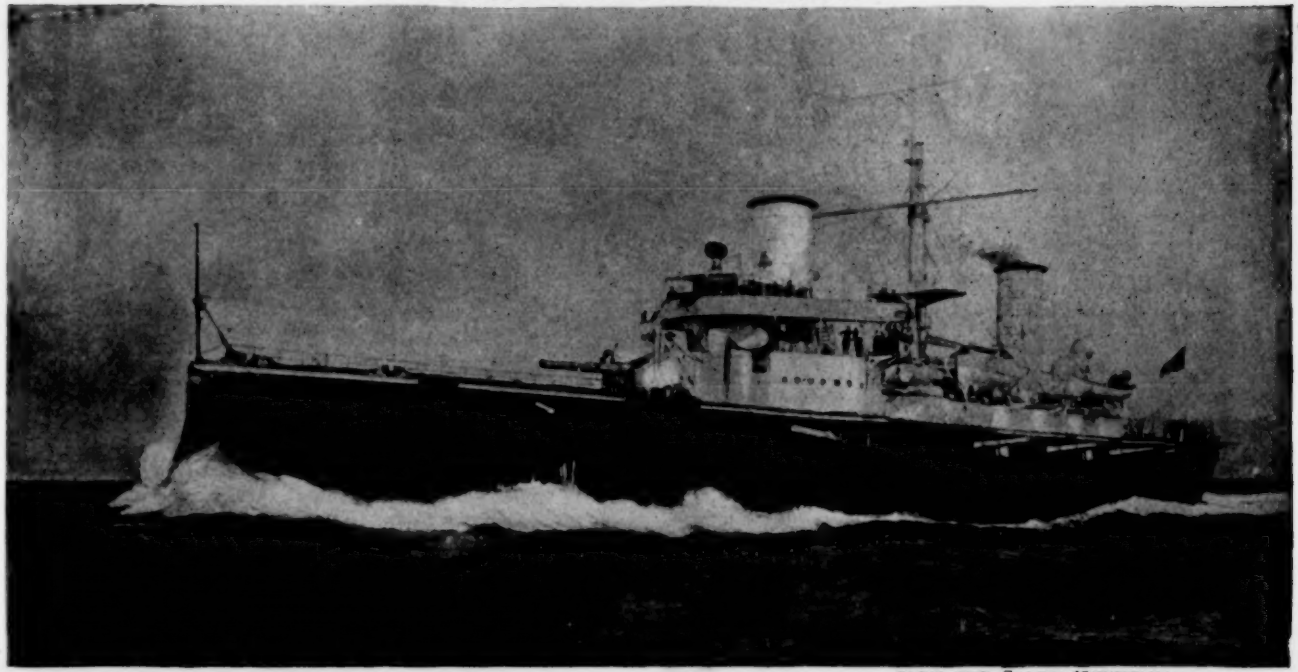
Dimensions.—Length between perpendiculars, 434.9 feet; length over all, 474 feet; beam, 73.5 feet; draft, 25.8 feet; displacement, 12,625 tons (metric).

GIUSEPPE GARIBALDI, VARESE: TRIALS, DESCRIPTION.—The Garibaldi, which is fitted with Niclausse water tube boilers, started on her preliminary trials July 12, 1900, but they were brought to an abrupt close by a distressing accident. Two of her boilers exploded within a few minutes of one another, killing one fireman instantly and badly burning and scalding two others. The cause of the disaster is unknown. The boilers were supposed to be in good order at the time. An inquiry into the causes of the explosion was ordered but no reports of the findings have been published so far as known to the compiler. After repairs and some alterations the Garibaldi completed her trials successfully. The results were as follows:



ITALIAN BATTLESHIP VITTORIO EMANUELE.
From the Rivista Marittima.

ITALIAN ARMORED CRUISER VARESE



FROM THE RIVISTA MARITTIMA

Kind of trial	Natural draft.	Forced draft.
Date	Aug. 17	Sept. 7
Duration of trial, hours	6	1.5
Steam at boilers, pounds	176.5	204.3
Steam at engines, pounds	138	155
Air-pressure, inches of water	—	.20 to .63
Revolutions, av. of both engines	89.3	106
Mean I. H. P.	9948	14,713
Mean speed, knots	16.2	19.7

All boilers were in use during both trials. The blowers were running during the natural draft trial but the fire rooms were not closed. The speed would have been greater if the bottom had been clean and the weather conditions more favorable.

The Varese, which is fitted with Belleville boilers, has also completed her trials, which passed off without stoppage or accident. The particulars are as follows:

Kind of trial	Nat. draft.	Forced draft.
Date	Oct. 20	Nov. 27
Displacement	7470	7475
Duration of trial, hours	6	1.5
Steam at boilers, pounds	155	201
Steam at engines, pounds	132	154
Coal used per sq. ft. of grate	17.87	24.98
Air-pressure, inches of water	—	.59 to .87
Revolutions	95.71	105.6
I. H. P.	9348	13,650
Speed, knots	18.352	20.02
Slip, per cent	16.84	17.8
Pitch of screw, feet	23.35	23.35

The ship came out of dock clean and freshly painted the morning of her natural draft trial. At the time of her forced draft trial she had been lying in the fitting out basin for nearly forty days. All boilers were in use at both trials. During the natural draft trials the blowers were running but the fire rooms were not closed.

The general appearance and arrangement of the Varese and Garibaldi class are similar to those of the Cristobal Colon. The midship superstructure extends between the barbettes of the heavier guns. The two smokepipes are 6.5 feet in diameter, extending 72 feet above the grate bars, are wide apart, and in the forward and after ends of the superstructure. One military mast placed amidships carries a large oblong top with its greatest diameter athwartships. Electrical power is ued for training the gun-houses, for ventilating engines, ammunition hoists, heating in pantry, lighting, etc. The hull is of steel without sheathing, divided into 250 water-tight compartments, of which 44 are in the double bottom.

Armament.—One 10-inch gun in a revolving gun-house over a barbette tower on the center line forward. Two 8-inch guns in a revolving gun-house over a barbette tower on the center line aft. Fourteen 6-inch guns: ten in central battery, five each side on gun deck; four on main deck in corners of superstructure. Ten 12-pounders: three on each side on main deck in superstructure; two each side on gun deck, one pair forward, and one pair aft. Six 3-pounders: four on the bridges; two in the top. Two machine guns. Four 17.7-inch torpedo tubes.

Protection.—Complete belt, 5 feet deep, 6 inches thick amidships tapering to 3.2 inches at the ends. Side armor above belt amidships covering gun-deck battery, 6 inches thick. Bulkheads at ends of battery, including bases of barbette towers, 4.7 inches. Armor around 6-inch guns in corners of superstructure, 6 inches. Protective deck 1.2 to 1.6 inches. Deck over battery, 1.9 inches. Barbette armor and fronts of gun-houses, 6 inches. Shields on all guns except those in gun-houses. Conning-tower, 4.7 inches.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines with cylinders 41, 63 and 93 inches diameter and 46 inches stroke. The Varese has 24 Belleville boilers in four fire rooms; and the Garibaldi 24 of the Niclausse type. The contract requirements with forced draft were: 13,500 I. H. P.; steam in boilers, 213 pounds; steam at engines, 155 pounds; revolutions not to exceed 116. Coal supply at load draft, 700 tons; total capacity, 1400 tons.

Dimensions.—Length over all, 357 feet; length between perpendiculars, 343.9 feet; beam, 59.7 feet; depth to main deck, 40 feet; mean draft, 23.3 feet; displacement, 7400 tons (metric) or 7326 tons of 2240 pounds.

JAPAN.

NEW TORPEDO-BOAT DESTROYERS.—The Minister of Marine has finally decided not to employ turbine engines for the new torpedo-boat destroyers on account of the large coal consumption at low powers. Two new destroyers, with engines of the ordinary type, have been ordered of Thorneycroft. They will be of 356 tons displacement and the machinery is to develop 7000 I. H. P. Two more destroyers of the Akebono class were ordered from Yarrow late in 1900.

HATSUSE: TRIALS.—This battleship of 15,000 tons has completed her trials. After docking, a 6-hour trial at four-fifths power gave a speed of 18 knots. With full power on a 3-hour trial the speed was 19 knots by revolutions. During the trial the ship made four runs over the measured mile, the mean of which was 19.1 knots. The Hatsuse is fully described in PROCEEDINGS No. 91, September, 1899.

VEDETTE BOATS: TRIALS.—Some vedette boats for Japanese battleships and cruisers were recently tried at Stokes Bay. The speed averaged about 18.5 knots, though one boat made 19.25 knots. The boats were built by Samuel White, of Cowes. The particulars are: Length, 56 feet; beam, 9.5 feet; depth, 5.25 feet; horsepower of machinery, 320; boilers, water-tube; total weight of machinery and boilers, 8 tons.

KATSURAGI: HAULED OFF REEF.—The small cruiser Katsuragi, of 1480 tons, which ran ashore on the coast of China during a typhoon, and which was reported wrecked, has been hauled off the reef without very serious injury.

YAEYAMA: NEW BOILERS.—The cruiser Yaeyama of 1600 tons, 5400 I. H. P., 19 knots speed, and launched in Japan in 1889, is to change her boilers and will receive new ones of the Niclausse type.

MEXICO.

For the first time in many years Mexico is building vessels for her little navy. One million Mexican dollars (about $480,000) has been appropriated to begin the work which is to be spread over five years. The vessels contemplated are eight gunboats of 1000 tons and 16 knots speed and two torpedo boats of moderate size.

NETHERLANDS.

BUDGET FOR 1901.—The Netherlands naval budget for 1901 amounts to 16,657,693.80 florins ($6,696,392.91—1 florin = $0.402). The following special items appear: Administration, $153,589.33; purchase of materials and expenses of new construction, $2,887,242.39; personnel, $1,776,573.88; for improvement of ports, coasts, pilot service, and hydrography, $1,008,854.38; pensions and subsidies, $870,145.88. The amount allotted to new construction is charged with the sum of $1,688,400 for: (*a*) the completion of three torpedo boats; (*b*) for continuing the construction of the small battleships Konigin Regentes, De Ruyter, and a third of the same class not yet named; (*c*) for commencing an armored coast-defense vessel.

NEW PROGRAM.—The building program, presented to the Netherlands parliament about a year ago, contemplates building within ten years five ships of the Konigin Regentes class, two of the Holland class, three small coast-defense ships (2130 tons, 850 I. H. P., 10 knots speed), seven protected cruisers, three monitors, twenty-one sea-going torpedo boats of the Forban (French) type, twelve smaller torpedo boats, fourteen gunboats, and five sloops. The total expenditure involved is 74,500,000 florins ($29,949,000).

ASSAHAN: TRIAL, DESCRIPTION.—This gunboat has recently completed her trials. The mean speed was 14 knots and the average I. H. P. 1353. The principal details are:

Armament.—Two 4-inch guns; two 3-inch; two 1-pounders.

Motive power.—Twin-screw, triple-expansion engines. Coal capacity, 118 tons. Radius of action 2200 miles at 10 knots.

Dimensions.—Length, 177.1 feet; beam, 30.83 feet; mean draft, 11.8 feet; displacement, 810 tons.

NORWAY.

BUDGET FOR 1900-1901.—The total amount of the naval budget for 1900-01 is 4,485,000 crowns ($1,201,980—1 crown = $0.268), an increase of 28,000 crowns over that of 1899-1900. The principal allotments are as follows: Administration, 54,000 crowns; officers of ships, 274,000; medical corps, 37,000; enlisted men and petty officers, 335,000; personnel of torpedo defense, afloat and ashore, 65,000; workmen, 334,000; administration of navy yards, 159,000; changes of organization, 80,000; naval schools, 361,000; exercises and cruising expenses (including a sum of 30,000 for mobilization), 1,045,000; new construction, 800,000; maintenance of the material of the fleet (repairs), 138,000; torpedo mines, 34,000; guns, 197,000; hospital service, 17,000; material for construction, 153,000; expenses of navy yards, 270,000.

NEW CONSTRUCTION.—The new construction comprises the completion of first-class torpedo boats No. 7 and No. 8, and of the transport Fram; continuing the construction of first-class torpedo boats No. 9 and No. 10; and commencing the construction of second-class torpedo boats No. 18 and No. 19. The cost of rebuilding the first-class gunboat Sleipner is included in this vote.

RUSSIA.

BUDGET FOR 1901.—The Russian naval budget for 1901 provides for a total expenditure of 97,097,666 roubles ($50,005,297.99—1 rouble = $0.515), divided as follows:

	Roubles.
Ordinary expenses	66,000,000
Increase in schools	10,000
Increase of the fleet	16,000,000
Supplement to the ordinary budget	10,000,000
Improvement of the Port of Vladivostok	2,000,000
Expenditures for hydrographic service	54,700
Improvement of Port Arthur	3,000,000
Expenses of naval administration in Kwangtung	32,966
Total	97,097,666

This divided in the following manner:

	Roubles.
Administration	2,349,020
Rewards and assistance	545,278
Schools	1,132,767
Medical service and hospitals	1,203,777
Pay of officers, sailors, etc.	5,392,547
Provisions	1,890,774
Clothing	2,881,869
Ships in commission	20,318,803
Hydrographic service	1,007,609
Hydrography of the mouths of the Yenisei and Obi	54,700
Lighthouses	300,000
Guns	11,965,107
Shipbuilding	17,805,439
Repairs of ships	7,797,676
Navy yards and factories	5,822,669
Ships other than naval and their repairs	5,654,341
Expenses of travel, etc	840,000
Various expenses	1,637,634
Construction of Port Emperor Alexander III	3,200,000
Improvement of Port of Vladivostok	2,000,000
Improvement of fortifications of Port Arthur	3,000,000
Advances on the new budget	297,656
Total	97,097,666

The shipbuilding allotment of 17,805,439 roubles is to be applied as follows:

	Roubles.
1. Construction of hulls of ships	7,800,000
2. Construction of machinery	5,300,000
3. Construction of armor	3,400,000
4. Fitting out and equipping ships	1,000,000
5. Reserve fund for shipbuilding purposes	305,439
Total	17,805,439

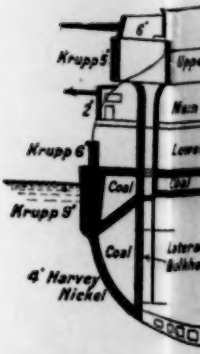
Item 1, construction of hulls, is subdivided as follows:

	Roubles.
Battleship Borodino at the New Admiralty Works	800,000
Battleship Orel, Galernaia I. Works	900,000
Battleship Imperator Alexander III, Baltic Works	1,400,000

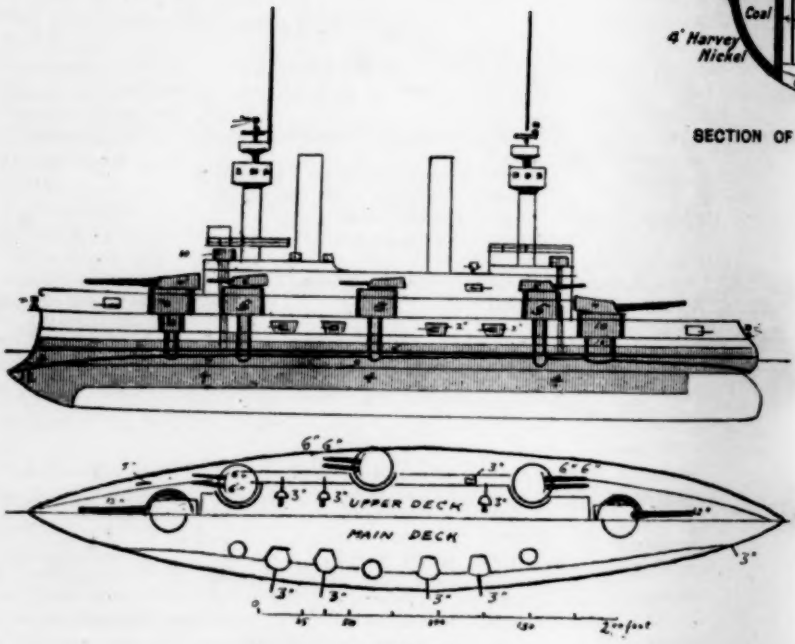
	Roubles.
Battleship Kniaz Suvarov, Baltic Works	900,000
Cruiser despatch-vessel of 3000 tons, Baltic Works	680,000
Collier of 7200 tons, New Admiralty Works	500,000
Battleship of General-Admiral Apraksin type (5000 tons) New Ad. Works	450,000
Imperial yacht of the Alexandra type	100,000
Two 59-foot torpedo vedette boats for convoying the new yacht	50,000
Cruiser of 6250 tons, Nicolaiev dockyard	699,280
Six torpedo-boat destroyers of 350 tons, Nicolaiev dockyard	300,000
Cruiser of 6250 tons, Lazarev dockyard	699,280
Steam transport of 318 tons, Sormov Works	3,440
Twelve torpedo boats in sections for Port Arthur	318,000
Total	7,800,000

VESSELS BUILDING.

Name.	Displacement (tons).	Where building.	Remarks.
Battleships.			
Borodino	13,516	New Admiralty Works, St. P.	Not launched.
Imperator Alexander III	13,516	Baltic Works, St. Petersburg.	"
Orel	13,516	Galernaia I., St. Petersburg.	"
Kniaz Suvarov	13,516	Baltic Works.	"
Tsarevitch	12,900	La Seyne, France.	Launched Feb. 23, '01.
Kniaz Potemkin Tavrichesky	12,585	Nicolaiev, Russia.	Launched Oct. 9, 1900.
X	12,585	"	Reported ordered; doubtful.
Retvisan	12,700	Cramp's Yard, Philadelphia.	Launched Oct. 23, 1900.
Pobieda	12,674	Baltic Works, St. Petersburg.	Launched May 24, 1900.
Oslabya	12,674	New Ad. Wks., St. Petersburg.	Launched Nov. 8, 1898.
Admiral Butakov	5,000	" "	Ordered.
Cruisers.			
Bayan	7,800	La Seyne, France.	Launched June 12, '00.
Bogatyr	6,750	Vulcan Wks., Stettin, Germany.	Launched Jan. 30, 1901.
A	6,250	Nicolaiev.	Ordered.
B	6,250	Lazarev.	"
X	6,375	Libau, Russia.	Reported to be bldg.
Y	6,375	Galernaia I., St. Petersburg.	Proposed.
Z	6,375	" "	"
Askold	6,000	Germania Wks., Kiel, Germany.	Launched Mar. 13, '00.
Aurora	6,630	Galernaia I., St. Petersburg.	Launched May 24, '00.
Novik	3,000	Schichau, Elbing.	Launched Aug. 15, '00.
Boyarin	3,000	Burmeister & Wain, Copenhagen.	Launched Sep., 1900.
Cruiser despatch-vessel	3,000	Baltic Works, St. Petersburg.	Ordered.
Miscellaneous.			
Collier	7,200	New Ad. Works, St. Petersburg.	Ordered.
Imperial Yacht.	?	?	"
Transport	318	Sormov Works.	"



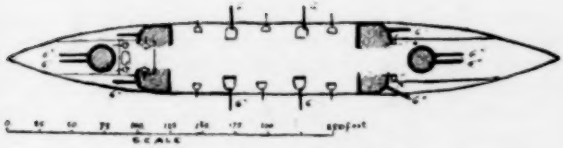
SECTION OF BORODI



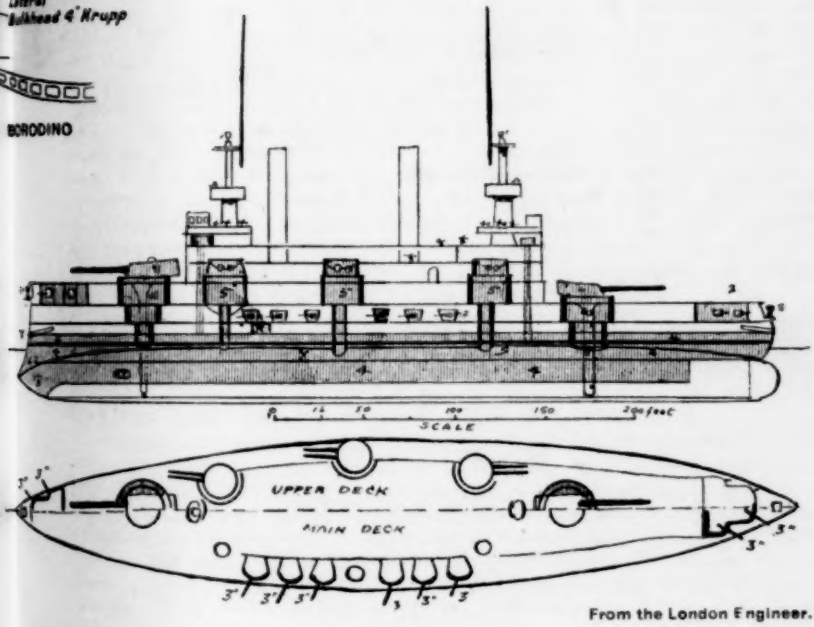
TSAREVITCH.

NEW RUSSIAN SH

OF BORODINO



RUSSIAN CRUISER BOGATYR



From the London Engineer.

BORODINO.

V RUSSIAN SHIPS.

VESSELS BUILDING—*Continued.*

Name.	Displacement (tons).	Where building.	Remarks.
Torpedo Boat Destroyers.			
Baklan	350	Nevsky Works, St. Petersburg.	Building.
Bekass	350	" "	"
Gorlitsa	350	" "	"
Kulik	350	" "	"
Perepel	350	" "	"
Skvorets	350	" "	"
Strij	350	" "	"
Chtchegol	350	" "	"
Albatross	350	New Ad. Works, St. Petersburg.	"
Drozd	350	" "	"
Diatel	350	" "	"
Six new boats	350	Nicolaiev.	Ordered.
Fasan	350	"	Practically complete.
Lebod	350	"	"
Pavlin	350	"	"
Pelikan	350	"	"
Osiotr	312	F. et C. de la M., Havre, France.	Launched Jan. 22, '01.
Forelle	312	" "	Launched Dec. 8, '00.
Losos	312	" "	Not yet launched.
Kefal	312	" "	"
Sterliad	312	" "	"
Kondor	220	? ?	Building.
Filin	220	Ijora Works, Russia.	"
Gagara	220	"	"
Krecet	220	"	"
Korsum	220	"	"
Sowa	220	"	"
Voron	220	"	"

BORODINO CLASS: DESCRIPTION.—There are four of this class under construction, as may be seen by a glance at the preceding table. So far as known they are exactly alike. According to some reports there are slight differences but the weight of authority is in favor of identical design and dimensions. The freeboard is high throughout, being 16 or 18 feet aft and 23 to 25 feet forward. Above the main deck the superstructure extends from the stem almost to the after turret; while above this, another superstructure extends between the turrets amidships. There are two military masts, each carrying one top and one searchlight platform. The special feature of these ships is the armor protection against torpedoes. The Tsarevitch, the prototype of the class, was the first to be so protected, and in the Borodino and her sisters the protection has been carried further. The principal details are:

Armament.—Four 12-inch guns in pairs in turrets forward and aft. Twelve 6-inch guns in six turrets, three on each beam, all slightly sponsoned, but only the midship one projecting beyond the beam at the water-line. The forward guns can fire directly ahead, the after ones directly astern, and the midship ones nearly ahead and nearly astern. Twenty 3-inch guns in casemates: six each side on the gun deck amidships; two each side on the gun deck aft; and two each side on the main deck forward. The 3-inch guns at the ends of the ship have fire parallel with the keel towards their own end of the ship. Twenty 3-pounders.

Eight 1-pounders. Four above-water torpedo tubes; two submerged tubes. The electric plant will be extensive and electric power will be used to operate the turrets, ammunition hoists, etc.

Protection.—Complete water-line belt, 9 inches thick amidships, tapering to 4 inches and 6 inches at the ends. Above this a complete narrow belt, 6 inches thick, except at the after end, where it is 4 inches. Below the main belt the torpedo defense belt, 4 inches thick, begins about 50 feet from the stern and ends at the stem, where it is only 1.5 inches thick, but deepened so as to cover the ram to the keel for a length of 25 or 30 feet. Inside the torpedo belt from the forward end of the fire-room to the after end of the engine room, a 4-inch vertical, armored bulkhead joins the lower edge of the torpedo defense belt to the knuckle of the protective deck where the slope joins the flat, thus forming a second defense against the explosion of torpedoes. Complete protective deck behind the main belt, from the lower edge of which the slopes of the deck rise. It is 3 inches thick on the slopes and 2 inches thick on the flat, the latter part being a little below water amidships and considerably more below at the ends. Two-inch flat armored deck on top of the belt, reduced in thickness at the ends. The turrets for the heavy guns are of the balanced type, 11 inches thick in front, and rest on barbette towers 10 inches thick, which rise a little above the deck and extend one deck down. Below that again there is a circular cylinder or tube of the same thickness but of less diameter, which, for the after guns, rests on the protective deck; but for the forward ones, being there one deck higher, there is a third armored cylinder of still smaller dimensions, connecting the intermediate cylinder to the protective deck. The 6-inch gun turrets are circular and 6 inches thick, placed over 5-inch barbette towers extending from a little above deck to the next deck below; thence connected to the protective deck by armored loading tubes. The casemates of the 3-inch guns are 2 inches thick in front.

Motive power.—Twin-screw, triple-expansion engines of about 16,000 horsepower. The Borodino, Orel, and Suvarov will each have 20 Belleville boilers, while the Imperator Alexander III will have boilers of the Niclausse type. The designed speed is 18 knots. The coal supply at load draft is 1250 tons and the total capacity 2000 tons.

Dimensions.—Length over all, 397 feet; length between perpendiculars, 376 feet; beam, 76 feet; draft forward and aft, 26 feet; displacement at this draft, 13,516 tons.

NEW BATTLESHIP.—The *Kronstadt Vestnik* states that a new battleship of nearly 13,000 tons will soon be commenced at Nicolaiev. The length will be 390 feet, I. H. P. 17,000, and speed 18 knots. The further statement is made that the engines have already been ordered from the Sormov Works. This looks like an improved Tavrichesky. There is no provision for such a vessel in any recent budget, but the Russian budget is not always to be literally followed in considering cases of this kind. Nevertheless, the information may be regarded as doubtful.

ADMIRAL BOUTAKOV.—This third-class battleship has been commenced at the New Admiralty Works, St. Petersburg. Her plans have been changed three times (or at least the reports of them have) since she was first projected. The latest report, which corresponds with the statement in the budget for 1901, is that her displacement will be 5000 tons and that the battery will consist of one 12-inch gun in a closed turret forward, and four 6-inch guns in pairs in two closed turrets, one each side amid-

ships. The hull will be protected by a complete water-line belt of armor and a protective deck.

NEW CRUISERS OF 6250 TONS.—These two cruisers are building at the Nicolaiev and Lazarev Yards on the Black Sea. They are of the Bogatyr type and differ very little from that vessel. A proposition to replace four 6-inch guns by two or four 8-inch has not yet been approved. So that at present the description of the Bogatyr, given on a subsequent page, applies equally to these vessels except as regards dimensions. In respect to displacement the apparent difference is greater than the real. With the same amount of coal as the Bogatyr carries at load draft, these cruisers would displace 6470 tons instead of 6250, their coal supply at load draft being only 500 tons. (See illustration facing page 182.)

CRUISER DESPATCH-VESSEL.—This vessel, which may be similar to the Boyarin, is called a despatch-vessel in some recent reports which give her a displacement of 3500 tons. Her profile is said to resemble that of the Imperial yacht Standart. She will have Belleville boilers.

TSAREVITCH: LAUNCH, DESCRIPTION.—This battleship is building at the yard of the Compagnie des Forges et Chantiers de la Méditerranée, La Seyne, near Toulon, France, and was launched February 23, 1901. She is the prototype of the Borodino class and differs from them chiefly in having less displacement and lighter armor.

Armament.—Four 12-inch and twelve 6-inch guns arranged as in the Borodino (see description of Borodino on a preceding page). Twenty 3-inch guns: eight in armored sponsons, four each side amidships; one each side on gun deck aft; one each side on main deck forward; one each side in superstructure on upper deck; three each side on bridge deck; the twelve last mentioned are not protected by armor. Twenty 3-pounders. Eight 1-pounders. Four above-water torpedo tubes and two submerged tubes.

Protection.—Complete water-line belt, 9 inches thick amidships and 4 inches at the ends. Upper belt same as Borodino. Lower belt similar, but probably only 2 inches thick. Similar vertical armor bulkhead, 2 inches thick. Protective deck 2.5 inches thick on the slopes. Flat deck on top of belt 0.7 inch thick. Protection to battery same as Borodino.

Motive power.—Same as Borodino, except has three screws. Belleville boilers.

Dimensions.—Length over all, 388.8 feet; beam, 75.5 feet; draft, 26 feet; displacement, 12,900 tons.

KNIAZ POTEMKIN TAVRICHESKY: LAUNCH, DESCRIPTION.—This first-class battleship is building at the government yard, Nicolaiev, where she was commenced September 27, 1897, and launched October 9, 1900. She is similar in design to the Tri Sviatitelia, whose design, in turn, was based upon that of the British battleship Trafalgar. There is one military mast forward and a signal mast aft. Rather low freeboard. Hull of steel without sheathing.

Armament.—Four 12-inch guns of 40 calibers length in turrets forward and aft. Sixteen 6-inch of 45 calibers: eight in central battery, four each side; eight in pairs in turrets (probably in Canet twin mounts) over corners of central battery. Fourteen 3-inch of 40 calibers. Sixteen 1-pounders. Two Baronovski boat guns. Four submerged broadside torpedo tubes and one tube above water in the bows.

Protection.—The water-line belt is believed to be nearly complete. It is 9 inches thick amidships with 7-inch bulkheads. Armor over central

battery and on 6-inch turrets, 5 inches. Turrets of heavy guns, 12 inches thick in front. The protective deck is complete and 3 inches thick on the slopes. The redoubt above the belt and enclosing the bases of the heavy turrets is 9 inches thick. Splinter screens between guns in the central battery, 2 inches.

Motive power.—Twin-screw, triple-expansion engines. Fourteen Belleville boilers. The engines were built by the Nicolaiev Building Works and the contract requires that on four runs in smooth water the I. H. P. developed shall be not less than 10,600 and the speed 17 knots.

Dimensions.—Length between perpendiculars, 370.7 feet; beam, 73 feet; mean draft, 27 feet; displacement, 12,585 tons.

RETVISAN: LAUNCH, DESCRIPTION.—This first-class battleship is building at the yard of the William Cramp & Sons' Shipbuilding Company, Philadelphia, where it was launched October 23, 1900. The general arrangement of armor and battery is similar to that of the Formidable class in the British navy. The hull is of steel without sheathing and with the usual double bottom and water-tight compartments. There are two masts, each carrying one military top and one searchlight platform. The forecastle and poop are at the same deck level. Between them on the main deck there is a superstructure rising one deck height. The complement is 38 officers and 700 men.

Armament.—Four 12-inch guns of 40 calibers in balanced turrets forward and aft with arc of train of 270 degrees. Twelve 6-inch guns of 45 calibers: four each side in casemates on the gun deck with arc of fire of 120 degrees; and two each side in casemates on the main deck with arc of fire of about 170 degrees, forward guns firing a little across the bow and after guns firing a little across the stern. Twenty 3-inch guns of 50 calibers: three each side on the main deck in the superstructure; two each side on the gun deck forward and two each side aft; lastly, one each side on the superstructure. Twenty 3-pounders, of which six are on the forward bridge deck and six are on the after one. Six 1-pounders. Two submerged torpedo tubes and four above-water tubes. The turrets and the ammunition hoists of all guns are operated by electricity.

Protection.—Water-line belt amidships between the turrets 9 inches thick and 7.5 feet wide, extending 4 feet below and 3.5 feet above water at normal draft. Above this belt the side is covered with a second belt of 6-inch armor up to the level of the gun deck. The ends of the 9-inch and 6-inch belts are joined to the barbette towers of the 12-inch guns by diagonal bulkheads of 9-inch and 6-inch armor respectively. Forward of this armor, for a depth equal to that of both belts, the hull is covered with 2-inch plating which extends down to the ram at the stem, following the edge of the protective deck. The protective deck extends from stem to stern, the sides sloping down to meet the lower edge of the belt; the flat, amidships, being about at the level of the load water-line. The slopes behind the 9-inch belt are 3 inches thick; forward and aft they are increased to 4 inches. The flat is 2 inches thick throughout. The turrets and barbette towers in the original design were 10 inches thick throughout but there is a strong probability that turrets and barbette towers similar to those of the Maine will be installed. The casemates are 5 inches thick. All armor over 3 inches thick is face-hardened by the Krupp process.

Motive power.—Twin-screw, 3-cylinder, triple-expansion engines with cylinders of 38.5, 59 and 92 inches diameter and 42 inches stroke. Twenty-

four Niclausse boilers in four compartments, designed to furnish steam at 256 pounds, reduced to 200 pounds at the engines; grate surface, 1353 square feet; heating surface, 58,104 square feet; three smokepipes, 100 feet high above grate bars. The designed I. H. P. of the machinery is 16,000 and the requirements of the contract are that the ship shall maintain a speed of 18 knots for 12 hours with natural draft. The total coal capacity is 2000 tons; in addition, certain compartments of the double bottom are fitted as tanks for containing liquid fuel.

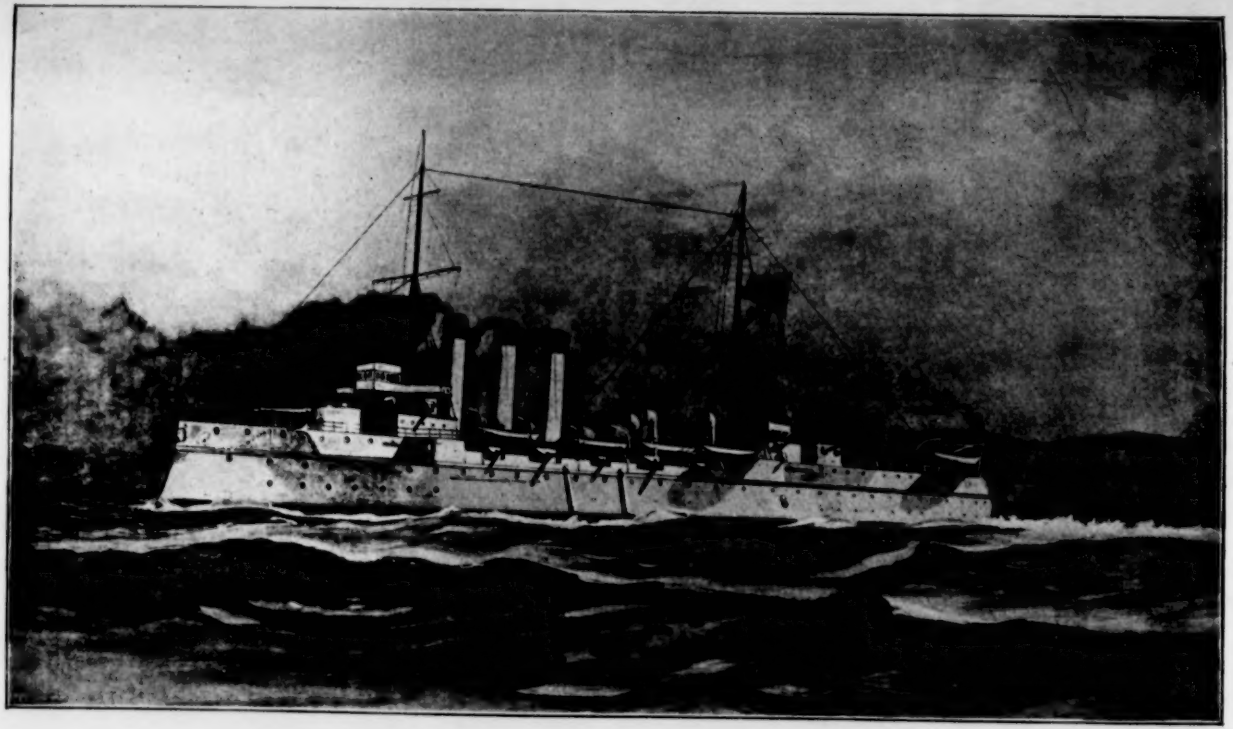
Dimensions.—Length on load water-line, 384 feet; beam, 72.2 feet; depth to main deck, 43.8 feet; draft, 25 feet; displacement at this draft, 12,800 tons.

BOGATYR: LAUNCH, DESCRIPTION.—The Bogatyr and Variag, like the new 6250 ton ships, are developments of the Pallada type. The increase in displacement is very little, the added weights being possible through economies in weight carried by the earlier vessels. The Bogatyr was built at the yard of the Vulcan Company, Stettin, Germany, where she was launched January 30, 1901. The freeboard is high forward and aft but somewhat less amidships. Above the main deck there is a forecastle of moderate dimensions and a very long poop. The bridge deck is over a broad deck-house on the after end of the forecastle, forward of the foremast; above this are the bridge and pilothouse. There are two pole masts and three smokepipes, the latter very far forward. The vessel carries two steam launches, one petroleum boat, and seven pulling boats. The complement is 21 officers and 550 men. The hull is of steel without sheathing. (See plans facing page 178.) The principal details are:

Armament.—Twelve 6-inch Obukov guns of 45 calibers (closely resembling the Canet model): four in pairs in closed turrets on the poop and forecastle; four in armored casemates on the main deck, one each side at after end of forecastle firing directly ahead, and one each side at forward end of poop firing directly astern; two each side on the main deck protected by shields. Twelve 3-inch guns of 50 calibers: three each side on main deck, four on the forward deck-house, and one each side on the forward end of the poop. Six 3-pounders. Four small guns. Two submerged torpedo tubes and two above-water tubes, one in the bow and one in the stern. Six searchlights: two on the forward bridge, two on the platform over the pilothouse, and two on the after bridge. There are two ammunition hoists for the turrets, four for the casemates, two for the 6-inch guns on the main deck amidships, three for the 3-inch guns, and two for the 3-pounders. They are worked by electric or hand power.

Protection.—Complete protective deck, 1.2 inches thick on the flat, 2.7 inches on the slopes amidships and 2.1 inches on the slopes at the ends. This deck consists of two thicknesses of plates screwed together, the upper layer being of nickel steel. The turrets of the 6-inch guns are 4.9 inches thick in front and 3.6 inches in rear; the front plates are face-hardened, the rear ones of nickel steel untreated. The casemates are 3.2 inches thick in front, closed in rear by plates of 1.4 inches. The ammunition hoists are in armored tubes 2.4 inches thick. The conning-tower on the forward bridge deck is 5.5 inches thick and the curved shield covering its entrance 3.5 inches. Both shield and tower are of face-hardened steel.

Motive power.—Twin-screw, 4-cylinder, triple-expansion engines. Sixteen Normand water-tube boilers. The designed horsepower of the machinery is 20,000 and the anticipated speed 23 knots. The coal supply at load draft is 720 tons and the total capacity 1430 tons.



RUSSIAN FIRST-RATE PROTECTED CRUISER, IMPROVED BOGATYR TYPE.
From the London Engineer.

Dimensions.—Length over all, 440.2 feet; length on water-line, 433 feet; beam, 54.4 feet; depth, 34.1 feet; mean load draft, 20.8 feet; displacement at this draft, 6750 tons.

PERESVIET: TRIALS.—The last trials of this battleship of 12,674 tons, which took place recently, were regarded as satisfactory although the horsepower was 725 below the requirements of the contract. The engines worked well, which was not the case on the first trial, as they had to be stopped on account of serious heating of the bearings. The deficiency in horsepower was attributed to irregular working of the boilers which experience will correct. The first, or preliminary trial, which took place about a year ago, gave results as follows: I. H. P., 14,532, or 32 over the contract; steam pressure, 169.5 pounds; speed not reported. The results of the last 6-hour trial were: I. H. P. of port engine, 4637.42; I. H. P. of middle engine, 4692.84; I. H. P. of starboard engine, 4445.11; total I. H. P., 13,775.37; average speed, 19.12 knots; average revolutions, 102; steam at boilers, 165 pounds; steam at engines, 139 pounds.

GROMOVOI: TRIALS.—The last trial of this armored cruiser of 12,336 tons took place in October, 1900, and gave the following results:

	Port engine.	Middle engine.	Starb. engine.	Total or average.
I. H. P.	5165	5274.44	5056.57	15,496
Revolutions	123	117.5	124.23	121.58
Steam at engines, pounds	165	171.3	173.3	169.9

The horsepower developed was 996 above the requirement of the contract. The speed is not reported, but was probably a little over 20 knots.

NICOLAI I: TRIALS ,UNSATISFACTORY.—This second-class battleship of 9700 tons, launched in 1889, had had her old cylindrical boilers removed and replaced by 16 of the Belleville type. Several trials, all giving about the same results, have shown the new boilers to be entirely inadequate to produce sufficient steam for the engines to develop their full power. So far the power developed has been only about 5000 instead of 8000, which is the capacity of the engines.

BAKLAN, BEKASS, GORLITSA, GRACH, KULIK, PEREPEL, SKVORETS, STRIJ, CHTCHEGOL: DESCRIPTION.—These torpedo-boat destroyers are building at the Neva Works, St. Petersburg. The hull is of steel with the usual watertight subdivision. The screws are protected as in the destroyers of the Sokol class. Each compartment will be fitted with a turbine capable of ejecting 80 tons of water an hour and there will be seven 5-inch hand pumps worked from the upper deck. All of the boats should be completed by May, 1902. The principal details are:

Armament.—One 3-inch gun, five 3-pounders, and three torpedo tubes.

Motive power.—The engines are twin-screw, 4-cylinder, triple-expansion, with cylinders 20.5 inches, 31.5 inches, 34 inches, and 34 inches in diameter. The boilers are four in number and of the Yarrow type, with a total grate area of 240 square feet and a heating surface of 12,800 square feet. The designed horsepower of the machinery is 4500 and the expected speed 26 knots. The coal capacity is 80 tons.

Dimensions.—Length, 210 feet; beam, 21 feet; mean draft, 5.8 feet; displacement, 350 tons.

OSETR, KEFAL, LOSSOS, FORELLE, STERLIAD: DESCRIPTION.—These five torpedo-boat destroyers are building at the Havre shipbuilding yard of the Forges et Chantiers de la Méditerranée Company. All are well

advanced. The Forelle was launched December 8, 1900, and the Osetr January 23, 1901. Every attempt has been made to lighten the weights carried without reducing strength or stiffness. All the outer sheathing and angles are of nickel-steel (4 per cent nickel), and in spite of the difficulty of working this material the finish is neat. The plates under water and for some distance above it are galvanized (or more properly zinc-coated). The particulars are:

Armament.—One 3-inch gun, five 3-pounders, two torpedo tubes.

Motive power.—Twin-screw, vertical, triple-expansion engines designed to develop 4750 horsepower with 310 revolutions. Four Normand water-tube boilers. The contract requires one trial of 8 hours at 14 knots; a 6-hour trial at maximum power for this length of time; a run at 22 knots on which the behavior of the engines and boilers is to be noted; and within two hours after its completion another trial at full speed. If the speed is less than 26 knots on the 6-hour full speed trial, but more than 24 knots, a boat may be accepted but the price will be subject to a reduction of 15,000 francs for each quarter of a knot above 25 and 25,000 francs for each quarter of a knot below 25. The total cost of each boat is about $300,000.

Dimensions.—Length, 187 feet; beam, 20.66 feet; draft, 6.5 feet; displacement at this draft, 312 tons.

SPAIN.

The building program of the cabinet which resigned in October included eight battleships of 12,000 tons, four armored cruisers of 8000 tons, and one hundred torpedo-boat destroyers and torpedo boats. Whether the present or some future administration will take up this program or devise another is uncertain. At present the scheme is laid aside. The Minister of Marine has proposed, and the proposal has been approved by the Spanish parliament, that the strength of the fleet in commission during the current year shall be as follows:

In home waters: one battleship (Pelayo), two coastguard vessels (Vitoria and Numancia), and one protected cruiser (Carlos V).

For special service: one third-class protected cruiser (Rio de la Plata), three third-class cruisers (Isabella II, Infanta Isabella, and Conde de Venadito), three torpedo gunboats (Vicente Yanez, Pinzon, Nueva España, and Temerario), two first-class gunboats, two despatch vessels, and four small craft.

The Liga Maritima Española has recently been formed and issues a *Boletin* of its own, the first number of which appeared on January 1. Like the British and German Navy Leagues it is devoted to the rebuilding and improvement of the navy.

TURKEY.

New Cruiser.—The new cruiser to be built at Cramps for the Turkish navy will be somewhat similar to the Denver but very much faster, the designed speed being 22 knots. The contract for the construction was signed December 24, 1900; but, according to late reports, the first payment had not been made, so that the actual construction had not yet commenced.

Repairs to Old Ships.—A contract has also been signed for the repair of the old battleship Assat-i-Tewfik at the Germania Yard, Kiel.

The other old battleships Mahmudieh, Feth-i-Bulend, Avni-Illah, Muin-i-Zaffer, and Mukadami-i-Häir are to be rebuilt at the yard of Ansaldo Brothers, Sampierdarena, near Genoa, where the work of rebuilding the Messudieh has already begun. Some difficulty is expected in getting the ships to Genoa, as most of them are unable to go under their own steam.

TORPEDO-BOAT DESTROYERS.—Two torpedo-boat destroyers, built for the Italian navy but reported as rejected for some reason, have been sold to Turkey. On trial the speeds were 27.1 knots and 27.4 knots, instead of 26 knots, the contract requirement.

UNITED STATES.

NAVAL APPROPRIATION BILL, 1901-1902.—The Naval Appropriation bill as finally passed provides for 22,500 enlisted men, 2500 naval apprentices and 50 additional warrant machinists.

Officers of the Navy, and officers and men of the Marine Corps, when detailed for shore duty in Alaska, Philippine Islands, Guam, or elsewhere beyond the continental limits of the United States, shall be considered as having been detailed for "shore duty beyond seas" and shall receive pay accordingly, with such additional pay as may be provided by law for service in island possessions of the United States.

Officers advanced in rank for meritorious service in the war with Spain will be carried as additional members in their own grade and be promoted with the number next ahead.

The Secretary of the Navy is directed to have the coast of Puerto Rico examined for determining the best site for a naval station and to report the result of the investigation to Congress. He is similarly directed in the case of the Philippine Islands.

The paragraph in regard to commissioning warrant officers is as follows: "Whenever, in view of the vacancies in the grade of ensign on July thirtieth of any year unfilled by graduates of the Naval Academy, the Secretary of the Navy shall so recommend, the President may appoint to that grade, as of July thirtieth, from among the boatswains, gunners, or warrant machinists, not exceeding six in any one calendar year. No person shall be so appointed who is over thirty-five years of age; who has served less than six years as a warrant officer; who is not recommended by a commanding officer under whom he has served; nor until he shall have passed such competitive examination as may be prescribed by the Navy Department."

The President is authorized to establish, and from time to time to modify, as the needs of the service may require, a classification of vessels of the navy, and to formulate appropriate rules governing assignments to command of vessels and squadrons.

Some of the most important items are as follows:

Pay miscellaneous	$ 600,000
Emergency fund, to be expended at the discretion of the President, and $50,000 to be immediately available	250,000
Outfits for 2500 naval apprentices, 100 hospital apprentices, and 5000 landsmen, at $45 each	342,000
Naval Training Stations: California, $30,000; R. I., $45,000	75,000
War College, $9200; Naval Home, $76,425	85,625
Ordnance and ordnance stores: procuring, preserving and handling material, etc., and target practice	500,000

Reserve supply of ammunition, $500,000; conversion of 6-inch guns to R. F. G., $25,000; purchase and manufacture of smokeless powder, $500,000; new machinery at gun factory, $150,000; reserve guns for auxiliary cruisers, $250,000; Torpedo Station, $65,000	1,490,000
Naval militia: arms, equipments, boats, books of instruction, etc.	60,000
Small arms, machine guns, R. F. G., ammunition, etc., for Marine Corps	100,000
Naval proving ground, additional land	25,000
Purchase, transport, storage, and handling of coal	2,000,000
Equipment of vessels	1,500,000
Hydrographic surveys and purchase of sailing directions, charts, books, etc.	100,000
To establish new coal depots at the discretion of the Secretary.	600,000
Land for naval station and for harbor and channel defense, Pearl Harbor, Hawaiian Islands	150,000
Civilian crews and expenses of naval colliers	350,000
Yards and docks, maintenance	500,000
Public works at Portsmouth navy yard: quay wall, grading, new offices, floating derrick, boat shop, general storehouse, etc.	364,500
Public works at Boston navy yard: new shops, extensions, etc., piers, wharves, paving, fire-protection system, saw-mill, spar shed, coal handling and storage plant, etc.	551,000
Public works at New York navy yard: boathouse, to continue work on granite and concrete dock ($300,000), fire-protection system, dredging, coal handling and storage plant ($100,000), piers on cob dock ($88,000), ordnance storehouse and slip, reconstruction and extension of buildings, quay wall, etc.	1,009,000
Public works at Philadelphia navy yard: extension of basin, electrical shop, retaining walls, new shops and extensions, extension of piers, general storehouse, sea-wall, etc.	695,230
Public works at Washington navy yard: new shops, extensions, etc.	318,210
Public works at Norfolk navy yard: to continue work on granite and concrete dock ($300,000), quay wall, fitting out basin, mooring slips, alterations and extensions	594,260
Public works at Mare Island navy yard: new shops and storehouses and completing, fire-protection system, fire boat, etc.	331,660
Public works at Puget Sound navy yard: grading, coal sheds and coaling appliances, new shops and extensions, fire protection, quarters for gunner, etc.	273,000
Public works at San Juan naval station: coaling facilities, etc.	40,000
Public works at Pensacola navy yard: coaling plant, wharves, etc.	41,500
Public works at Algiers naval station: shops and offices, coaling plant, purchase of land, etc.	330,000
Public works at Dry Tortugas: dredging channel	100,000
Four dry docks: towards completion of dry docks at Portsmouth, N. H., Boston, Philadelphia, and Mare Island	1,000,000
Public works at naval station, Hawaii: machine shop and smithery, foundry, commandant's house and stable, extending office building, cottage for watchman, water-pipe system, grading and fencing, etc.	107,300
Public works at Tutuila naval station: coaling plant ($200,000), grading ($25,000)	225,000

Public works at Charleston, S. C., naval station: concrete and stone drydock ($150,000—cost not to exceed $1,250,000); also all appropriations for Port Royal naval station made prior to June 7, 1900, and still unexpended, made available for Charleston station 150,000
Repairs and preservation at navy yards and stations..... 500,000
Total for public works, Bureau of Yards & Docks..... 6,775,010
The Secretary is directed to report to Congress the condition and extent of public land on Blythe Island, Georgia; whether the title is good and whether the land is adapted to the needs and necessary wants of the Navy Department; to establish and mark the boundary line of this property and to lay out rifle range and construct boat landing, there is appropriated..... 2,000
Naval Academy: construction of buildings and necessary improvements 3,000,000
Naval Training Stations (Public works, Bu. Nav.): California, $6000; R. I., $52,175 58,175
Public works, Bureau of Ordnance: Iona Island, $100,000; Dover, $65,000; Fort Mifflin, $56,000; Norfolk magazine, $60,500; Torpedo station, $25,000; Indian Head proving ground, $11,600 318,100
Bureau of Medicine & Surgery, total..... 210,000
Provisions for the navy 3,250,000
Bureau of Construction and Repair: general fund for repair, preservation, and completion of ships..... 7,000,000
Improvement of construction plants at navy yards and stations. 335,000
Bureau of Steam Engineering: general fund for care and preservation, and completion of new work..... 2,120,000
Purchase of material and stores and care of same and of machinery, etc., on shore 1,110,000
Machinery plant, Philadelphia 100,000
Machinery plant, Mare Island 100,000
Marine Corps: pay and allowances of officers on the active list. 416,900
Pay of non-commissioned officers and privates, etc..... 1,112,548
Provisions, etc., for men on shore 371,071.50
Clothing 290,199.54
Increase of the Navy:

The Secretary is directed to prepare plans for two battleships and two armored cruisers and submit same to next Congress. No appropriation. Also to review and further consider the questions of sheathing, weight and extent of armor, form and location of turrets, as to whether changes are desirable in number and kind of guns carried, what torpedo tubes should be built in large ships, and all other important questions now pending among naval architects and ordnance experts concerning battleships and cruisers; which review and opinion he is to transmit to Congress, so far as he may deem it expedient to do so; and he is authorized to use his discretion in regard to sheathing or not sheathing any vessels already appropriated for.

Increase of the Navy: construction of hulls, outfits and machinery of vessels authorized 21,000,000

Increase of the Navy: armament and ammunition for vessels authorized 4,000,000
Increase of the Navy: equipment of vessels authorized..... 400,000

VESSELS BUILDING.—The following was the degree of completion of vessels under construction for the United States Navy on February 1, 1901, as shown by the records of the Bureau of Construction and Repair: Battleships—Illinois, 88 per cent; Maine, 42 per cent; Missouri, 23 per cent; Ohio, 37 per cent; No. 13, 0 per cent; No. 14, 0 per cent; No. 15, 0 per cent. Armored cruisers—No. 4, 0 per cent; No. 5, 0 per cent; No. 6, 0 per cent; No. 7, 0 per cent; No. 8, 0 per cent; No. 9, 0 per cent. Sheathed protected cruisers—Denver, 38 per cent; Des Moines, 15 per cent; Chattanooga, 19 per cent; Galveston, 9 per cent; Tacoma, 14 per cent; Cleveland, 44 per cent. Monitors—Arkansas, 47 per cent; Nevada, 79 per cent; Florida, 59 per cent; Wyoming, 68 per cent. Torpedo-boat destroyers—Bainbridge, 88 per cent; Barry, 86 per cent; Chauncey, 87 per cent; Dale, 90 per cent; Decatur, 90 per cent; Hopkins, 70 per cent; Hull, 69 per cent; Lawrence, 99 per cent; Macdonough, 98 per cent; Paul Jones, 82 per cent; Perry, 89 per cent; Preble, 82 per cent; Stewart, 47 per cent; Truxton, 54 per cent; Whipple, 53 per cent; Worden, 53 per cent. Torpedo boats—Stringham, 98 per cent; Goldsborough, 99 per cent; Bailey, 99 per cent; Bagley, 98 per cent; Barney, 99 per cent; Biddle, 97 per cent; Blakely, 98 per cent; De Long, 98 per cent; Nicholson, 84 per cent; O'Brien, 88 per cent; Shubrick, 97 per cent; Stockton, 99 per cent; Thornton, 95 per cent; Tingey, 67 per cent; Wilkes, 75 per cent. Submarine torpedo boats—Plunger, 5 per cent; Adder, 27 per cent; Grampus, 6 per cent; Moccasin, 18 per cent; Pike, 5 per cent; Porpoise, 15 per cent; Shark, 12 per cent.—*Army & Navy Journal.*

CONTRACTS FOR NEW VESSELS.—The contracts for the new battleships and cruisers have been awarded as follows:

Name.	Where building.	Contract price.	Cont. signed.
Sheathed battleships.			
Virginia (No. 13)	Newport News Co.	3,590,000	No report.
Nebraska (No. 14)	Moran Bros., Seattle.	3,733,000	"
Georgia (No. 15)	Bath Iron Works.	3,590,000	"
Unsheathed battleships.			
New Jersey (No. 16)	Fore River Works.	3,405,000	"
Rhode Island (No. 17.) ...	"	3,405,000	"
Armored cruisers, sheathed.			
Pennsylvania (No. 4)	Cramp, Philadelphia.	3,890,000	Jan. 10, 1901.
West Virginia (No. 5)....	Newport News Co.	3,885,000	Jan. 24, 1901.
California (No. 6).....	Union Iron Works.	3,800,000	Jan. 10, 1901.
Armored cruisers, unsheathed.			
Colorado (No. 7).....	Cramp, Philadelphia	3,780,000	Jan. 10, 1901.
Maryland (No. 8)	Newport News Co.	3,775,000	Jan. 24, 1901.
South Dakota (No. 9)	Union Iron Works.	3,750,000	Jan. 10, 1901.
Protected cruisers.			
St. Louis (No. 21)	Neafie & Levy, Phila.	2,740,000	?
Charleston (No. 22).....	Newport News Co.	2,740,000	?
Milwaukee (No. 20)	No satisfactory bid; readvertised March 7.		

According to reports received too late for verification the name Pennsylvania has been transferred to Armored Cruiser No. 4 and that of

Nebraska transferred to Battleship No. 14. Several reports concur in this. These vessels were all completely described in the last number of the PROCEEDINGS (No. 96). It is also reported that the Board of Construction has decided that none of the battleships or armored cruisers will be sheathed. This will necessitate changes in the contracts.

ARKANSAS, NEVADA: LAUNCH.—The Arkansas was launched at Newport News, November 10, 1900; and the Nevada at Bath, Me., November 24. Both are of 3235 tons and sister ships in all respects to the Wyoming, fully described in PROCEEDINGS No. 96, page 717.

ALABAMA: FINAL TRIAL.—The final trial of the Alabama in commission, which took place very recently, was satisfactory in all respects. The speed with natural draft was 16.2 knots and the corresponding horsepower was 7506.

ILLINOIS: PRELIMINARY TRIAL.—The preliminary builder's trial of the battleship Illinois, 11,565 tons, took place on March 11. It was satisfactory in all respects. The official trial will probably take place in April.

BAGLEY: LAUNCH, DESCRIPTION.—This first-class torpedo boat was launched at the Bath Ironworks, Bath, Me., September 25, 1900. She is one of three building at this yard; the others being the Barney, which was launched in July, 1900, and has had preliminary trials, and the other the Biddle, which has not yet been launched. These boats are similar in all respects; the complement is 3 officers and 26 men; and the principal details are:

Armament.—Three 17.7-inch torpedo tubes; three semi-automatic 3-pounders.

Motive power.—Twin-screw, vertical, quadruple-expansion engines. Normand water-tube boilers. Designed I. H. P. of machinery, 4200; speed, 28 knots.

Dimensions.—Length on load water-line, 157 feet; extreme breadth, 17 feet; mean draft, 4.65 feet; extreme draft aft, with bunkers full, 8 feet; displacement, 167 tons.

BLAKELY, DE LONG: LAUNCH, DESCRIPTION.—These first-class torpedo boats are similar in all respects and were built at the yard of Messrs. George Lawley & Sons, South Boston, Mass., where they were launched, the Blakely on November 22 and the De Long on November 23. The keels of these boats were laid January 12, and January 24, 1899, respectively. The contract price was $159,400 each and they were to have been completed in one year from the date of the contract, which was September 27, 1898; but, as has been the case with all the torpedo boats, the construction has been slow. The complement is 3 officers and 26 men; and the principal details are:

Armament.—Three 17.7-inch torpedo tubes and three semi-automatic 3-pounders.

Motive power.—Twin-screw, vertical, quadruple-expansion engines. Three Thorneycroft water-tube boilers, two in a compartment forward of the engines and one in a compartment abaft them. Designed I. H. P. of the machinery, 3000; speed, 26 knots. Coal supply, 10 tons; bunker capacity, 70 tons.

Dimensions.—Length on load water-line, 175 feet; extreme breadth, 17.5 feet; mean draft, 4.67 feet; maximum draft aft with stores and full bunkers, 7.5 feet; displacement, 165 tons; tons per inch of draft at mean load, 5.4.

LAWRENCE, MACDONOUGH: LAUNCH, DESCRIPTION.—These torpedo-boat destroyers are building at the yard of the Fore River Engine Com-

pany, Weymouth, Mass. The Lawrence was launched on November 7, and the Macdonough on December 24, 1900. They are alike in all respects. The contract for the construction was signed September 29, 1898, and the keels laid on April 10, and April 21, 1899, respectively. The contract price was $281,000 each. As the contract time was two years it has already been considerably exceeded. The hull is of steel, galvanized to one foot above the load water-line. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch, 50 caliber guns; five semi-automatic 6-pounders; two tubes for long 17.7-inch torpedoes.

Motive power.—The engines are twin-screw, vertical, triple-expansion, with cylinders 22, 31, 34, and 34 inches diameter and 20 inches stroke. The boilers are of the Express type, water-tube, with grate area of 320 square feet and heating surface of 18,000 square feet. The designed horsepower of the machinery is 8400 corresponding to a speed of 30 knots at 360 revolutions. The normal coal supply is 34 tons and the total capacity 115 tons.

Dimensions.—Length on load water-line, 242.25 feet; extreme breadth, 22.25 feet; mean draft, 6.18 feet; displacement, at this draft, 400 tons; tons per inch of immersion at normal draft, 8.56.

PERRY, PREBLE: LAUNCH, DESCRIPTION.—These two torpedo-boat destroyers are building at the Union Ironworks, San Francisco, Cal. The contract was signed October 5, 1898, and the boats were to be delivered in eighteen months. The contract price was $285,000. The keel of the Perry was laid April 19, 1899, and she was launched October 27, 1900. The keel of the Preble was laid two days later and she was launched March 2, 1901. The boats are alike in all respects. The complement is 4 officers and 69 men. The principal details are:

Armament.—Two 3-inch guns of 50 calibers; five semi-automatic 6-pounders; two torpedo tubes for long 17.7-inch torpedoes.

Motive power.—Twin-screw, vertical, triple-expansion engines. Thorneycroft water-tube boilers. Designed horsepower of machinery, 7000; speed, 29 knots. Normal coal supply, 25 tons; total capacity not reported.

Dimensions.—Length on load water-line, 245 feet; extreme breadth, 23.6 feet; mean draft, 6.5 feet; maximum draft aft with all coal and stores, 7.56 feet; displacement at normal draft, 420 tons; tons per inch of immersion at normal draft, 9.4.

STOCKTON: TRIAL.—This torpedo boat of 165 tons is completing at the yard of the Wm. R. Trigg Company, Richmond, Virginia; which company is also building the Shubrick and Thornton. The contract for the construction was signed November 16, 1898; contract price, $129,750; time for completion, one year. The keel of the Stockton was laid March 18, 1899, and she was launched in the early part of last year. She is of the same dimensions as the Blakely and De Long, described on a previous page, carries the same armament, and has the same machinery, boilers, coal capacity, etc. Her trial took place in Chesapeake Bay, November 28, 1900, with the following results:

	Revolutions.	Steam at engines.	Vacuum.	Air pressure.
Starboard	*	249.8	23.15	3.0
Port	356.5	247.3	21.30	3.0

*The starboard counter broke down during the trial.

The horsepower developed was about 3400; and the average speed was 25.79 knots. This was below the 26 knots required by the contract, but as the boat was loaded to a displacement of 200 tons instead of the normal of 165, it was regarded as eminently satisfactory. The engines worked well and without undue vibration, but there was considerable vibration of the bulkheads, which caused breaks in the cylinder drain pipes, water-service pipes, and disarranged the starboard revolution counter.

HOLLAND: SURFACE RUN.—On January 8 the Holland started from Annapolis for Norfolk, Va., attended by the tug Standish. She arrived at Norfolk 48 hours and 25 minutes after starting, having stopped once to rest the crew and three times for other causes. The reports of Lieutenant Caldwell, her commanding officer, and of Lieutenant-Commander Edwards, who was on board for the purpose of taking data and making observations of her performance, are published in the *Journal of the American Society of Naval Engineers* for February, 1901; and they are very interesting and instructive, but are too long to insert here in full. The following data are from Lieutenant Caldwell's report:

a. Distance run, 145 knots.
b. Time underway, 25 hours 36 minutes.
(Time at anchor, or stopped, 22 hours, 49 minutes.)
c. Average speed, 5.67 knots.
d. Maximum speed, 7 knots.
e. Consumption of gasoline for propulsion, 125 gallons.
f. Consumption of gasoline for charging battery, 20 gallons.
g. Capacity of gasoline tank, 1300 gallons.
h. Reserve capacity (ballast tanks), 3500 gallons (approximating).
i. Consumption of engine oil, 12 gallons.

The air storage is comprised in three sets of flasks (each of about 12 cubic feet capacity) with air at a pressure of 2100 pounds per square inch. For convenience in comparing supply with consumption, this is referred to as 6300 pounds of air. The compressor can raise the pressure in any one set of flasks about 350 pounds per hour. Using this notation:

k. Amount of air in flasks at beginning of run, 6300 pounds.
l. Air compressed during run, 8850 pounds.
m. Air remaining at end of run, 2600 pounds.
n. Air used during run, 12,500 pounds.
o. Average consumption of air per hour for steering engine and whistle, 488 pounds.
p. Voltage on battery at beginning of run, 126.
q. Voltage at beginning of recharging, January 9, 109.
r. Voltage at end of recharging, 124.
s. Voltage at end of run, 120.
t. Maximum temperature in boat (engine compartment, engine running), 60 degrees Fahrenheit.
u. Minimum temperature in boat, 45 degrees Fahrenheit.
v. Weather, generally fair.
w. Wind, moderate to light southerly breeze.
x. Sea, generally choppy.
y. Draft, 8 feet 6 inches.
z. Condition of bottom, foul.
a. Pitching and rolling, not noticeable.

AMMUNITION.

KRUPP CAPPED PROJECTILES.—Krupp has recently taken out a British patent (Granted October 17, 1900) for a new form of cap. The idea is to provide a cap for a projectile so that capped or uncapped projectiles, which are—except for the cap—of the same weight, can be fired from the same gun without change of elevation or powder charge. It must be remembered, in this connection, that almost every European nation still uses shells of two weights, necessitating two weights of charge to give the same velocity. The shape of Krupp's new cap is very much more pointed than ours and extends much farther beyond the point of the projectile. It would seem to be very ineffective at oblique impact, as it could hardly fail to be detached or broken off on account of its excessive projection beyond the point of the projectile.

JAPANESE HIGH EXPLOSIVE SHELL.—It is reported that Japan has adopted a high explosive, of Japanese invention, for use in all shell up to and including 8-inch caliber.

COMBINATION PRIMERS.—Combination electric and percussion primers are coming into favor abroad if the number of patents taken out is any indication. The Skoda Company, of Pilsen, Bohemia, has brought out one (British patent granted August 1, 1900). In the primer for metallic cases the electric wire passed through a hole in one side of the head, then winds around in a score at the bottom of the thread and enters the primer below the percussion cap. The primer for guns not using fixed ammunition is similarly arranged. The electric wire winds about the primer as before in a helical score cut in the outer surface. The object of combination primers is of course to give a quick change to percussion in case of failure of the electric mechanism. But in a well-fitted and well cared-for electric system the failures need not exceed one in a hundred—and that due to a broken wire in the primer, usually—provided the firing current is of ample voltage. Not less than 10 volts is sure and 12 to 15 is better. With this no grime, dirt, moisture or grease in the primer seat will cause failure in a single wire system.

ARMOR.

Very few armor trials have taken place during the past quarter as winter is not very favorable or convenient for such work. The only two plates tested, so far as the compiler has observed, are those whose trials are described below.

The Japanese are building an armor plant of their own and making preparations to supply most of their wants in the way of ships, guns, and armor. This seems to indicate that they intend to continue the strengthening of their fleet, which has recently had such great accessions.

Messrs. Beardmore & Company are coming rapidly to the front as armor manufacturers and have the only armor factory on the Clyde. They have greatly increased the capacity of the armor department of their Parkhead establishment and are now turning out about 600 tons of armor per month, chiefly for the British navy. Until within a few years, these works have not produced much armor since the days of wrought iron, when they furnished plates for some of the earliest British armor-clads.

Sir W. Armstrong, Whitworth & Company, Limited, is now able to

supply armor from its Openshaw Works, Manchester. It is a noticeable fact that within a few years several of the great British armor and gun-makers have developed their facilities until they are now able to produce all the principal essentials of a warship—hull, armor, and guns. Thus, the Vickers Company, beginning with armor, acquired a large ship-building plant and now makes guns. Sir J. Brown & Company, armor makers, have recently purchased the Clydebank shipbuilding yard and probably will soon have a gun factory. The owners of the Parkhead Works—originally a machinery and armor plant—have bought the Govan shipyard, and they too may soon become gun-makers.

Our armor controversy attracted much attention in Europe, where the price of armor was somewhat greater than in the United States, and now is very much greater. In Germany our successful stand for lower prices has brought about a fight against Krupp, hitherto a sort of German demi-god who could do no wrong. A concise statement of the situation from the *Army and Navy Gazette* is given below:

PRICE OF ARMOR IN GERMANY.—Some curious facts have been disclosed in the report of the Budget Committee of the Reichstag on the German Navy estimates, which throw a side light upon what the opponents of the expansive policy of the Government describe as "business patriotism." Before the Navy Bill became law the *Berliner Neueste-Nachrichten* and the *Post*, newspapers which belong to Herr Krupp and Baron von Stumm, were among the foremost advocates of an increase of the German fleet, a fact which did not escape the critics of that measure. The reason of this earnest advocacy now almost seems to be apparent. Herr Krupp and Baron von Stumm possess, or are chiefly interested in, monopolies for the manufacture of armor plates for the Navy, and the price paid to them is 2320 marks per ton, being 400 marks in excess of the price paid for armor in the United States, and the circumstance is the more curious because the American manufacturers pay to Herr Krupp and Mr. Harvey 142 marks per ton for the use of the patents. It is estimated by the Budget Committee that the difference in price means a loss to the German Government of 3,000,000 marks a year, and consequently of 60,000,000 marks before the new fleet can be completed under the Navy Law. The criticism of the Committee is trenchant. "In view of this monstrous extortion on the part of the two firms which have secured a monopoly in the manufacture of these plates, it is thought necessary either to encourage foreign competition or to establish Government works for the manufacture of nickel-steel armor plate. A resolution to this effect has been carried by fifty votes to four."—*Army and Navy Gazette*, March 9.

Just as the NOTES are about to be closed and sent to the printer, I notice in the last foreign mail received that, "The proposal of the German Budget Committee that a State foundry should be established for the production of armor plates has been passed at a plenary sitting."

TRIAL OF A 6-INCH CARNEGIE, KRUPP PROCESS, NICKEL-STEEL PLATE.—The trial took place on February 23, 1901, at the U. S. Naval Proving Ground, Indian Head.

Plate: 6 inches thick; curved turret plate, supported against ordinary backing (not fitted to curve of plate), and representing 250 tons of armor for the Russian battleship Imperator Alexander III.

Rounds 1, 2, and 3. Gun: 6-inch. Velocities, 1910 to 1930 foot-seconds. Projectiles: Midvale-Holtzer; weight 100 pounds. Centers of impact

about equidistant. Line of fire: practically normal to surface of plate. Result on plate: penetration of first shot, 1.7 inches; maximum penetration, 2 inches; no cracks and comparatively little flaking; metal showed fine grain like tool steel. Result on projectiles: broken up into small pieces; those of first rounds, which remained in the plate, were shaken out by subsequent rounds.

This was certainly a very excellent plate, probably never excelled, but its exact merit was not determined, as the test was for acceptance only and not to ascertain its full resisting powers.

TRIAL OF A 6-INCH ARMSTRONG EXPERIMENTAL, SPECIAL PROCESS, NICKEL-STEEL PLATE.—The trial took place February 7, 1901, at the British government proving ground, Whale Island, Portsmouth.

Plate: 6-inch experimental plate; 8 feet by 6 feet; made by Sir W. Armstrong, Whitworth & Co., Limited, at the company's new Openshaw armor factory near Manchester.

Rounds 1, 2, 3, 4, and 5. Gun: 6-inch. Velocities, 1970 to 2016 foot-seconds. Projectiles: English Holtzer. Line of fire: normal to surface of plate. Centers of impact symmetrically placed, four at corners of a square and one in its center. Result on plate: no shots perforated plate; penetration not reported; no cracks. Result on projectiles: broken up.

The merit of the plate is undetermined from the reports. It may be a good plate. But all good 6-inch plates will stop 6-inch projectiles at velocities not exceeding 2200 foot-seconds without cracking and without perforation.

COALING SHIP.

A most excellent article on this subject by Lieutenant-Commander Edwards is published in the February number of the *Journal of the American Society of Naval Engineers*. It is very full and exhaustive, treating of coaling ship under all conditions. Its length and the variety of points treated preclude any satisfactory review of it in these notes. Following it in the same number of the *Journal* is an equally valuable article upon the steaming radius of American ships of war by Lieutenant Bryan, in which is given the radius of action of almost every ship in the navy under various conditions of speed, etc.

RECENT COALING RECORDS OF BRITISH BATTLESHIPS.—The following is clipped from the *Army and Navy Gazette* of February 23, 1901: Last week we chronicled the fact that the Majestic had regained the record for coaling from the Prince George, which had recently captured it. Now we have to note that the Mars has snatched it from the Majestic, her average of tons per hour being 203.8 to the 200.3 of the flagship. The coaling of the five battleships which formed the Portsmouth division of the Channel Squadron was utilized on this occasion by Commander Heathcote, who has just undertaken the control of the depôt to obtain certain data for his guidance in the future. The ships were coaled both from the shore and from lighters alongside, the latter being fitted with Temperley transporters. Of the five vessels the Prince George alone had the disadvantage of three hours of artificial light, and her performance in these circumstances is the more creditable. The following are the particulars of the evolution as carried out on board the five ships:

Ships.	Date.	Tons shipped.	Working hours.	Average tons per hour.
Hannibal	Jan. 14	943	5h. 45m.	170
Prince George....	Jan. 25	1,220	6h. 30m.	187.7
Resolution	Jan. 28	1,215	7h. 10m.	169.5
Majestic	Feb. 4	1,230	5h. 50m.	200.3
Mars	Feb. 6	1,070	5h. 15m.	203.8

COMMUNICATIONS.

NOTE.—Under this head will appear notes on Signaling, Telegraphy, Ocean Cables, Carrier Pigeons, etc.

SUBMARINE SIGNALING.—Mr. Arthur J. Mundy, assisted by the late Professor Elisha Gray, have developed a system of submarine signaling by the use of a submerged bell. Their experiments showed that the sound of a large submerged bell might be heard on a ship at a distance of a mile, provided the observer went down in the hold and listened when as near the skin of the ship as possible. "The sound waves produced by the bell come through the water and penetrate the skin of the ship, diffusing themselves in the atmosphere of the hold, where they are recognized by the unaided ear, just as any local sound might be. The sound is heard more plainly, however, by placing one end of a wooden rod against the skin of the ship and pressing the other against the outer ear. A common tin ear trumpet, such as is used by a deaf person, screwed into the end of a piece of gas pipe and submerged a few feet, the mouth of the trumpet being sealed with a tin diaphragm, will enable the observer at the upper end of the pipe to hear the bell a distance of three miles."

For greater distances, Professor Gray invented an electric submerged receiver, which could be connected up with an ordinary telephone receiver in the pilot house or elsewhere. An 800 pound bell, specially arranged for being struck electrically, was recently experimented with and the results were: "At 1.5 miles the sound of the bell was very loud and very distinct; at 4 miles the sound was quite as distinct and almost as loud as at 1.5 miles; at 8 miles the sound was quite as distinct as at 1.5 miles and almost as loud as at 4 miles; at 12 miles the sound was heard at times quite distinctly, and at times somewhat feebly. Even at 12 miles the sound received was sufficient to give a practicable warning signal. By means of bells and a receiver which will determine the direction of the sound it is proposed to adapt the discovery to giving warning signals of the proximity of dangers to navigation."—From an article by Mr. Mundy in the *Scientific American*. The apparatus, or a modification of it, might also be used for communication between ships.

CONSTRUCTION.

NOTE.—Under this head will appear notes on Design, Materials, Sheathing, etc.

RUSTING OF IRON.—Ordinary red rust is essentially an oxide of iron, containing combined water and practically identical with jewellers' rouge, which is nearly pure ferric oxide, Fe_2O_3. The ordinary chemical explanation of the process is that the iron combines with the oxygen of the air according to the equation

$$2Fe_2 + 3O_2 = 2Fe_2O_3$$

or, taking the combined water into account, according to the equation

$$Fe_2 + 3O + 3H_2O = Fe_2O_3, 3H_2O.$$

That these simple equations do not represent the actual facts of the case has been known for years, as well as the fact that iron placed in contact with an alkali does not rust. To explain this fact it has been suggested that the presence of carbonic acid gas is necessary for rusting to take place, and that the alkalies absorbing this prevent rusting. On this view the phenomenon of rusting according to Professor Crum Brown, takes place in two stages, as follows:

1. $4[Fe + H_2O + CO_2] = 4FeCO_3 + 4H_2$.
2. $4FeCO_3 + CH_2O + O_2 = 2Fe_2(OH)_6 + 4CO_2$.

A close investigation of the matter has, however, led Mr. W. R. Dunston, F. R. S., to question this theory, and to conclude that the presence of CO_2 is by no means necessary for the production of this red rust. Thus, five pieces of bright iron were taken, the first was placed in dry oxygen, the second in water vapor, the third in liquid water, the fourth in a mixture of pure oxygen and water and vapor. In none of these cases was any rust formed. The fifth specimen, however, was placed in liquid water charged with pure oxygen, and the production of rust was then quickly apparent, although no CO_2 was present. In fact, for this rust to be formed it is essential, Mr. Dunstan finds, that the iron shall be in contact with liquid water, and with oxygen. A piece of bright iron placed in a receiver over a dish of water remained perfectly bright for sixty hours, provided that the temperature was kept constant, so as to prevent the condensation of the water on the metal. A similar piece, similarly suspended, but without any precaution against this condensation, soon showed spots of rust. Reasoning on the results of the experiments just described, and on the fact that alkalies prevent the formation of rust, Mr. Dunstan suggests that the real active agent is hydrogen peroxide. To test this, iron was suspended in water, to which were added substances, some of which decompose this peroxide, whilst the others have no such action. In every case the former prevented the production of rust, whilst it always occurred in the latter. In addition to the alkalies, which destroy peroxide, potassium bichromate, potassium ferro-cyanide, and sodium nitrate, were tried. These, whilst destroying the peroxide, are, unlike the alkalies, powerful oxidizing agents, yet nevertheless they proved efficient protectors of the metal. In another experiment a piece of iron was immersed in a solution of hydrogen peroxide, which was made just alkaline. Under these conditions, although the peroxide was decomposed and oxygen was freely liberated at the surface of the metal, the latter did not rust. The whole phenomena of rusting is then, according to Mr. Dunstan, effected by the iron taking up O from the water, forming ferrous oxide, and producing peroxide of hydrogen; the latter then immediately combines the ferrous oxide to form the red rust.—*Engineering*, London.

Sheathing of the U. S. Coast Survey Steamer Bache.—In answer to a request from Captain C. D. Sigsbee, Chief Intelligence Officer, U. S. N., he has been furnished with fifteen different reports concerning the condition of the steamer Bache, made between May 13, 1889, and April 9, 1899, by Lieutenants J. F. Moser and R. G. Peck, U. S. N.; P. A. Walker, Asst. C. and G. Survey; H. G. Ogden, Insp. Hydry. and Top., a U. S. Local Inspector and a Board of Inspection. Summing up these

reports Chief Constructor Philip Hichborne, U. S. N., Chief of Bureau, says:

"To summarize, it may be stated that this vessel, not originally intended to be sheathed, was, nine years after her launching, fitted with a system of sheathing which involved a neglect of some of the most obvious precautions in such work, and the use of iron bolts; and in the execution of which the workmanship was bad. She served thirteen years continuously without an examination of, or repairs to, her sheathing or sheathing bolts, and is to-day in active service, though nearly thirty years old, with her frames and plates in such a condition through internal corrosion in the machinery and bunker spaces as would have long since compelled her abandonment or extensive rebuilding had she not been sheathed; without the sheathing applied twenty years since having been renewed or the bottom plating sighted or repaired. That these results are possible under such conditions speaks volumes for the possibilities of an efficient system based upon experience (in which every precaution is taken and neutral non-corrosive and brass bolts are employed), executed with scrupulous regard for the highest class of workmanship; in a service where periodical examination and proper care is fully provided for."—*Army and Navy Journal.*

Galvanic Action of Copper Sheathing.—The opponents of copper sheathing for our warships will find strong confirmation of their criticisms in the very ugly discovery that was made the other day on the British cruiser Ariadne, and later on another cruiser, the Spartiate. Copper sheathing was introduced to enable ships to remain at sea for longer periods than is possible when the steel plating of the hull is unprotected. The theory is good, and the practice of it would be equally so were it not for the disadvantage that the galvanic action of copper on other metals in the presence of salt water is liable to be very destructive. As long as the metal bolts which fasten the wood sheathing to the inner steel hull can be kept perfectly water-tight, and the salt water prevented from getting in contact with the steel hull, sheathing is no doubt an excellent device; but experience seems to prove that it is extremely difficult to preclude conditions favorable to galvanic action. In some cases the steel plating has been badly attacked, while in others, the fitting of the sea valves and other outboard connections have been seriously damaged. During the latter part of August, the Ariadne, a new British cruiser of 11,000 tons displacement and 21 knots speed, was found to be leaking rapidly while at her moorings. The leak was of such dimensions that it was assumed that a Kingston valve had inadvertently been left open.

After the vessel had been hurriedly docked, it was ascertained that the corrosion of the bolts, both inside and outside of the ship, had been so extensive that the mounting of one of the underwater fittings had fallen off, allowing a great inrush of water. The corrosion of the outer bolts of the Spartiate, a sister ship, had previously been detected, and on docking the vessel it was found that the inner bolts had also been corroded.—*Scientific American.*

The facts concerning the Ariadne and Spartiate are correct, but the remarks concerning sheathing are only partly true. The causes of rejection of sheathing for our new vessels are not so few nor so definite as here stated. The reasons against sheathing armored ships are more serious than those against sheathing ships without belt armor. First and

foremost is the difficulty of attaching the sheathing to hard-faced armor; secondly, the difficulty and cost of heavy bronze stem and sternposts and trouble of fitting the butts of the sheathing in a secure and strong manner; then there is the extra cost entailed by sheathing; fourthly, possible galvanic action; and lastly, it is not yet proved that sheathing will do all its extreme advocates claim for it. Want of accurate data on this point is to be deplored. People are apt to take violent sides on the question of sheathing with very insufficient reason. The compiler began to collect data on this subject some years ago but the greater part was lost in the wreck of the Charleston. In the United States Navy we have had very little experience with sheathing, but the British and French have had much. Quite half of their large cruisers of recent date are so fitted and, up to the present, but little trouble has been experienced with them. Certainly the accidents to the Ariadne and Spartiate are a new departure and must have had special and unusual causes. Of course a small amount of corrosion is expected and is usually found, but it is ordinarily of little importance. Corrosions due to different causes, but quite as serious in character, are occasionally found in unsheathed ships.

Bilge Keels for Torpedo-Boat Destroyers.—Experiments are to be carried out at Portsmouth to determine whether, and if so to what extent, bilge keels would affect the speed and manœuvring power of torpedo-boat destroyers. A 30-knot vessel is to be selected, and she is to have her decks cleared of torpedo-tubes and other obstructions in order to provide room for 50 men in addition to the crew. The boat is to be run without bilge keels at 15, 20, and 25 knots, and the men are to be so distributed as to produce the maximum of heel consistent with safety while the vessel is underway. The boat is then to be docked and provided with bilge keels, after which precisely the same trials are to be gone through. If it be found that there is no material depreciation of speed and manœuvring power, bilge keels will be supplied to all the destroyers, with a view to improving the steadiness of their gun platforms.—*Engineering*, London.

GUNPOWDER AND EXPLOSIVES.

Erosion of Guns.—The causes of the erosion of guns are not yet all definitely known; but that the principal cause is the chemical action of the powder, promoted by the mechanical action of the projectile, seems to the compiler to be fairly well established. This theory, which has not, so far as observed, been published, is briefly as follows:

In those powders in which there is an excess of oxygen beyond what is barely necessary to turn the carbon of the powder into CO and the hydrogen into H_2O, the erosion is serious; and the amount of erosion is greater as the excess of oxygen is increased. No accounts are at hand of any experiments in which the amount of erosion has been carefully measured and it is therefore impossible to say just how the rate of erosion varies, but that it increases with increase of excess oxygen is clearly evident from various reports of the action of powders of different types. The pure gun-cotton powders have either no excess oxygen, or very little, depending upon their type, while the powders containing nitro-glycerin have a good deal, the amount depending chiefly upon the percentage of that ingredient.

When the powders which are rich in oxygen are exploded, there is liberated sufficient of this gas for forming CO with some additional oxygen. There is also the oxygen of the air enclosed in the gun which is heated to a point at which it will combine with any oxidizable substance. The additional oxygen may—and probably most of it does—at once combine with the CO to form CO_2. But part of it may unite with the surface of the metal of the gun where it has just been rubbed clean by the passing projectile and form Fe_3O_4. If any Fe_2O_3 were to form at the high temperature at which the gases are immediately after explosion, it is likely that it would be immediately reduced to Fe_3O_4. However, the point is unimportant, probably. It is possible, but doubtful, that some H_2O_2 would be formed if the excess of oxygen were very great. If so, it would be immediately reduced by the metal, or by the CO, in the former case accelerating the formation of iron oxide (see notes on Construction—Rusting of Iron). Whatever of iron oxide is formed in front of the seat of the rotating band of the shell (of course after the shell has moved forward) will be swept away by the next shell as it passes through the bore and the process of oxidizing repeated.

In view of the fact that CO will reduce iron oxides at high temperatures, it is possible—probable, even—that the Fe_3O_4 formed on the interior of the bore will be reduced to iron again almost as soon as formed. But the metal which has been oxidized will be left in a soft, spongy state, almost as easily swept away by the band of the projectile as if were still oxidized. This brushing away of the surface of the bore would produce exactly such effects as are complained of in guns using cordite, ballistite, and other nitro-glycerin powders. The top of the land wears faster than the bottom of the groove, as the pressure is greater upon it, though of course the metal in the groove is also worn to some extent. The action of the nitrogen is not taken into account, as this inert gas is not liable to oxidize in the presence of uncombined carbon, hydrogen, and iron; indeed, the high temperature and shock of firing might quite as likely result in the production of a small amount of ammonia as of a nitrogen oxide.

Erosive Effects of U. S. Navy Smokeless Powder.—At Indian Head, according to the report of the Chief of Bureau of Ordnance, four-inch gun No. 212 has been fired 661 times and five-inch gun No. 133, 666 times, with the navy smokeless powder without causing enough erosion or wear to be measured with the instruments in use at the proving ground.

Navy Smokeless Powder: Keeping Qualities; Ignition Powder.—Samples of 5-inch powder, which had been in the magazine of the Marblehead for two years, were tested at Indian Head, and there was not the least deterioration in ballistic qualities nor sign of chemical change. Another sample, kept in the magazine for one year, showed equally good results. So far no smokeless ignition powder has been found that gives acceptable results. Great variations in pressure have resulted from attempts to use a smokeless ignition charge in place of one of black powder. This variation is almost always in the nature of an increase of pressure; and this is generally 25 per cent, sometimes reaching 50.

Pure Nitro-Cellulose Powders: Regular Velocities.—Those powders which are made of pure nitro-cellulose, all of the same formula —in other words pure chemical compounds before colloiding—should in theory give more regular velocities than powders made up of several

sorts of nitro-cellulose, or of nitro-cellulose and nitro-glycerin. It is known that cordite and ballistite at different temperatures give velocities differing as much as two and a half per cent and that other causes than temperature affect their velocity appreciably. Lieutenant Dawson, late of the British navy, but now one of the artillery engineers of the Armstrong Company, states that in a pure nitro-cellulose powder is apparently our only hope for getting very high and regular velocities.

BALLISTITE: DETERIORATION.—A dispatch from Rome to the New York *Sun*, dated March 16, 1901, says:—"Several million cartridges charged with ballistite, a new explosive to which the Italian military authorities have pinned their faith, were recently found in a damaged condition, and the Italian Minister of War immediately ordered a special inquiry into the affair.

"It is now announced that the inquiry demonstrated the fact that ballistite deteriorates after a certain period, the actual length of which has not been made known. The committee recommended the adoption of a more reliable explosive.

"Meantime, of course, ballistite must be retained. But the fact that a large proportion of the cartridges now in store are steadily becoming unfit for use causes alarm. The present stock aggregates 200,000,000 cartridges." Ballistite is a first cousin to cordite. Its erosive effects have been heard of frequently but this is the first report of deterioration. It is composed of nitro-glycerin, nitro-cellulose, and camphor formed into a colloid. The proportion of its ingredients vary within small limits to adapt the powder to different uses; but the patent specifications of its inventor, Mr. Alfred Nobel, describes the manufacture as follows: "Dissolve 10 parts by weight of camphor in 100 parts of nitro-glycerin, and then add 200 parts of benzole. Carefully steep 50 parts of dry nitro-cotton pulp in this mixture and then evaporate the benzole. Then mix thoroughly by passing between steam-heated rollers. When this mass becomes homogeneous, roll out into sheets, and finally cut up into grains or mould into any desired shape."

FOSSANO POWDER WORKS: TO BE REBUILT.—It is reported that the Italian government proposes to rebuild the great powder works at Fossano which, since the advent of smokeless powder, have been almost entirely abandoned. The renovated works will be fitted with new and extensive plant for the manufacture of smokeless powder and of ordnance supplies.

LYDDITE: POOR WORK IN SOUTH AFRICA.—Referring to lyddite, a writer in the *Times* remarks that this explosive has failed to give satisfaction in South Africa, very few of the shells detonating satisfactorily. This, he states, is due to the peculiar nature of the substance, which is unsuitable for use in shells of less than 100 lbs. weight, and if bigger, so much the better. The fact that the shells used are reported to have given rise on bursting to greenish-yellow fumes is itself evidence that proper detonation had not been attained, since in that case the smoke is black. The difficulty is not a question of fuze or primer, but is inherent in the nature of the explosive, which in larger shells gives every satisfaction.—*Engineering*, London.

MAXIMITE: TRIAL.—In the London *Engineer* appears the following note in regard to a recent trial of this explosive: "Maximite, a high explosive invented by Mr. Hudson Maxim, was tested at Sandy Hook recently. According to accounts, a 1000-lb. 12-inch shell was filled with

70 lbs. of Maximite and fired through a 7-inch plate without explosion. thus making it equal to wet compressed gun-cotton in this respect. By exploding the Maximite a 12-inch shell was broken into about 10,000 fragments." The report does not state how the shell was exploded. The question is: Can Maximite be fired through armor *and exploded on the other side?* That's where the hitch is with gun-cotton. It will go through the armor all right, but the fuze or other means to cause certain explosion on the other side is yet to be invented.

NEW JAPANESE EXPLOSIVE.—This has been already referred to in the notes under the head of AMMUNITION. It is intended for the bursting charges of shells and probably has a picrate base.

CAUSE OF INSTABILITY OF NITRO-COTTON.—A very interesting and complete investigation into the nature of commercial gun-cotton has led Messrs. A. Luck and C. F. Cross to the conclusion that the main cause of the instability of the cellulose nitrates is not to be found in traces of the nitrating acids still remaining in the finished product, since this can only happen when the manufacture is carried on in a careless manner. They attribute this instability rather to the presence of certain peculiar cellulose derivatives which they find to be produced under even the most careful conditions of manufacture. These compounds are in intimate association with the nitrated cellulose, and cannot be removed by washing with either hot or cold water, or by digestion in cold solutions of soda, or by dissolution in ether, alcohol, or benzine. On the other hand, the compounds referred to are very soluble in acetone and certain other solvents, even when these are so diluted with water as to have little or no action on the cellulose nitrates themselves. By treating the nitrate cottons in this manner, the experimenters state they have prepared structureless gun-cotton of quite an exceptional character, obtaining it in the form of a very fine dense white powder of great purity and stability and entirely free from all mechanical impurities. This powder can be compressed into large masses for military purposes.—*Engineering*, London.

GUNS.

In these notes the use of the term Rapid-fire Gun is avoided as far as possible. The reason is that the term no longer expresses anything. It once could be defined as a gun with rapid working—almost instantaneous—breech action, using fixed ammunition. It is now used indiscriminately to express guns using fixed ammunition; or ammunition in which the charge and projectile are separate, but the charge in a metallic case; or ammunition in which the charge is put up in bag or envelope of combustible material and fired by a separate primer. The breech mechanism of all guns up to eight-inch caliber is now operated by a straight pull level action. In the higher natures Krupp claims the term R. F. for his 9.4-inch and 11.02-inch guns. Guns of exceptionally speedy operation will be referred to as rapid-firing, or rapid-loading guns.

RAPID LOADING OF GUNS.—It seems probable that within a very short time more efficient methods of loading heavy naval guns will be adopted. Krupp has led the way in his new 9.4-inch and 11.02-inch pieces. A description of his methods has not yet appeared, but the direction in which we are to look for improvement seems well defined. The breech must be opened and closed automatically and rapidly. The projectile and

powder charge must be loaded at one operation and the present system of bringing up the ammunition in several parallel cylinders done away with. To achieve this satisfactorily a little more room will probably have to be made in rear of the guns. But if the gain is such that we can load a 12-inch gun in twenty seconds, it is surely worth the expense. Our 8-inch turrets are all too small for rapid work. A slight increase of size would double the rate of fire by giving sufficient room to handle the ammunition easily.

CALIBERS OF GUNS.—The improvement of armor is at last bringing about the displacement of the 6-inch gun from its commanding position as the principal auxiliary gun of European battleships. For a time we, most unwisely I think, dropped the 8-inch gun from our battleship batteries, following European practice. Now we have reinstated it at a time when almost all Europe is considering about adopting a heavier gun than the 6-inch for the principal auxiliary piece. Italy has frankly thrown the 6-inch aside and adopted the 8-inch for both armored cruisers and battleships. The British are about to introduce a 7.5-inch piece, and there are rumors that the new German battleships will carry 8-inch guns in place of 6-inch. The mixed battery of our battleships could, I think, have been improved by doing away with the 6-inch caliber altogether. To keep our lead in construction we should adopt a battleship of 16,000 tons and 21 knots speed, carrying four 12-inch guns, sixteen 8-inch guns, and thirty-two 3-inch. This seems a very heavy battery. But it is not so difficult to instal as might be supposed. Let us start with a ship like one of our battleships of the Georgia class as originally designed with four 8-inch turrets on the main deck. Below and between these, resting in a recess cut in the upper works, instal another 8-inch turret; and superpose a turret on each 12-inch. That gives the sixteen 8-inch. Since the ship will be about 450 feet long she will carry seven 3-inch each side on the gun deck forward of the 8-inch turrets and five each side abaft them; three each side on the forward bridge deck, and one each side on the after one.

NEW 11.02-INCH KRUPP GUN.—Herr Krupp has announced the development of a 28-centimeter rapid-firing gun. It is stated that this piece will be mounted in the new German battleships instead of the 9.4-inch gun.

VICKERS-MAXIM GUNS.—In connection with letters which have recently appeared in the *Times* under the heading of "Our New Service Guns," commenting on certain details of design, the *Times* of the 15th inst. states that in the case of the 6-inch Vickers gun over 500 rounds were fired to test the mechanism and the general working of the system, with the result that large numbers of these guns have now passed into the service and have given excellent results after extended use. In the case of the 6-inch gun, too, a rate of fire of 11 rounds per minute has been obtained during trials, developing energies nearly 100 per cent greater than those in the preceding service weapon of this caliber. The heavier calibers of guns were also proved to be satisfactory after adequate tests under service conditions. Messrs. Vickers, Sons, and Maxim, Limited, have received instructions from the Japanese Government for the supply of three different types of guns having the same mechanisms as those now in use by the British government. The guns are to be shipped to Japan at the earliest possible time, and their special feature is that they are to be capable of developing very high energies. The guns consist of (1) a 6-inch gun having a velocity of 3000 foot-seconds, and

firing at a minimum rate of from eight to ten aimed rounds per minute under service conditions, as is the case with the existing British service guns now being installed in our new ships and fortresses; (2) a 12-pounder ship gun of 50 calibers, having a velocity of 3000 ft. and a rate of fire not less than 15 rounds per minute; (3) a 12½-pounder landing gun of very light construction, carrying 50 per cent more ammunition than is usually the case with our British service guns, and being capable of dealing with ranges up to 7000 yards. The same company is also supplying to the Spanish government a 14-centimeter gun of nearly the same power as the 6-inch gun now used by the British government, the details of construction of the mechanism being practically similar. They are also making a 6-inch gun for the United States Army,having a velocity of 2850 feet, with their special type of De Bange obturator quick-firing mechanism, similar to that adopted by the United States Navy about two years ago, when the government acquired from Messrs. Vickers the manufacturing rights of the mechanism for the Navy on payment of a quarter of million dollars. In addition to this Messrs. Vickers are adapting their heavy mechanism to a 24-centimeter Austrian gun, which is to be taken under trial by that government in February next. Such a general application of this type of mechanism to foreign ordnance is gratifying at a time when the enterprise of British manufacturers is a matter of criticism.—*Engineering*, London.

SIGHTING GUNS FOR BRITISH TURRETS.—According to the *Westminster Gazette*, the Admiralty have decided that all sighting guns for turrets and barbettes are to be replaced by three-pounder quick-firing guns. These sighting guns are mounted on the tops of turrets and barbettes, and as they are controlled by the training and elevating mechanism of the larger guns, they prove most useful for instructional purposes, besides enabling captains of guns to ascertain the exact line and elevation for the larger armament in action, thus saving a large amount of ammunition, time, and labor.—*Engineer*, London.

Of course the day has passed away when the range could be determined in action by the fall of small caliber projectiles, except under unusual circumstances; and this last comment was doubtless added by some uninformed critic belonging to the press. But for the purposes of sub-caliber practice this arrangement is a good one and would enable the drill at the gun to take place at the same time as the target practice, and this would further simulate the conditions of battle. Besides, the placing of sub-caliber guns inside larger ones is objectionable for many reasons.

GUNS: FIRING.

NOTE.—Under this head will be given notes referring to firing tests of guns, target practice, special practice, accidents to guns while firing, etc.

ACCIDENT TO KEARSARGE'S 13-INCH GUN.—A projectile recently exploded in one of the Kearsarge's 13-inch guns and injured the rifling to such an extent that it is considered advisable to have the gun relined.

GUN ACCIDENT ON THE THUNDERER.—While the battleship Thunderer was on her way from Pembroke dock to Devonport on Thursday, an accident occurred to her two turret guns, the cause of which is so far unexplained. The vessel left Pembroke about nine a. m., and when off Milford a target was put out for firing practice, the 10-inch breech-loading

turret guns being used. A projectile had been placed in one of the guns and the electric contact made, when there was an explosion quite different from that which usually accompanies the discharge of a projectile. Nothing came out of the gun except a few fragments of the projectile, which were thrown some distance from the ship. The base plate of the projectile was left in the gun, as well as a portion of the frame, and when the plate was afterwards removed, it is reported that the pressure of the gas left in the gun caused a portion of the projectile to be expelled with some force from the breech end of the gun. How such a thing could happen is by no means evident. On the second gun being fired, says the *Western Morning News*, a complete hole, between 2 inches and 3 inches in diameter, was blown through the projectile, the outer part, together with the base plate, being left in the gun. In this case, however, the base plate was separated from the rest of the projectile. Such a thing is believed never to have occurred on any ship before. The only explanation so far suggested is either that the powder in the projectile was damp or that there was a quantity of water in the guns. A cast will be made of the inside of each gun to ascertain whether either has been damaged. So far as can be seen from the outside both guns are sound.—*Engineer*, London, Nov. 9, 1900.

GUN ACCIDENT AT SANDY HOOK.—While testing smokeless powder in a ten-inch B. L. rifle at Sandy Hook on March 7 an explosion occurred and some damage was done to adjacent buildings. It seems that the breech block of the gun was not completely closed when the gun was fired and it blew out, thus causing what has been erroneously termed an explosion. No one was injured and no blame has been attached to any one for the occurrence. It is one of those unusual happenings which occur at the tests from time to time. The War Department has been informed that a six-inch gun while being fired at Fort Wadsworth on March 11 was thrown from its carriage, but with no damage to anything or any one. The cause of the upsetting of the gun is not known in Washington.—*Army and Navy Journal.*

BREECH PLUG BLOWN OUT OF ITALIAN 5.9-INCH GUN, ARMSTRONG MODEL.—The following letter appeared in *Engineering* (London), March 1, 1901:

SIR.—I have been able to gather the following particulars, which I beg to put before you, as they may prove of interest to your readers:

On the 24th ult. gunnery practice was being carried out with a quick-firing 149-millimeter (5.9-inch) A. gun, Armstrong type, on board the gunnery ship Terribile, in the Spezia roadstead. At the firing of one round the breech-block was blown off and the cartridge-case driven to the rear, killing four gunners on the spot, four others being severely burnt by the escaping gas. This gun had been built at the Royal Arsenal of San Vito, Spezia, on plans supplied by Elswick; it is on the type proposed by Elswick in 1889 to the Royal Italian Navy, both for the 120-millimeter (4.7-inch) and 149-millimeter (5.9-inch) guns, and which was adopted by the Italian Admiralty.

In 1890 a very similar accident occurred in the same roadstead to a 120-millimeter (4.7-inch) gun of the same type. The breech-block was blown off into the sea and could not be recovered; the steel was found to be partly torn in one of the threaded parts of the breech-block seating. After this first accident Messrs. Armstrong decided to alter the threads of their 120-millimeter (4.7-inch) gun breech-blocks.

Have we any guns of this type in the British Service? If so, the sooner they are found obsolete by the responsible authorities and replaced by improved weapons, the better it will be.

I am, Sir, yours faithfully,

February 22, 1901. VERAX.

GUN MOUNTS.

TRIAL OF NEW ARMSTRONG MOUNT FOR 9.2-INCH GUN.—A trial was carried out at Portsmouth at the 21st inst. on board the experimental vessel Drudge, of the mark V. mounting, designed by Sir W. G. Armstrong, Mitchell & Co., for the 9.2-inch guns to be mounted in ships of the Cressy and Drake classes. The weight of the gun is 28 tons, it is mounted on a cradle, recoils in the line of fire, and is automatically returned to the firing position by means of springs placed beneath the cradle. This is the usual principle of the Elswick quick-firing mounting so generally in use; but the present 28-ton guns are the heaviest to which this method has been applied in Her Majesty's service. The automatic sighting arrangement is worked by means of gearing from the cradle. The projectiles are lifted by means of a hydraulic cylinder from a revolving shell carrier, which is travelled by hand gear round the gun-house. They are then transferred to a revolving shell tray fixed to the cradle, from which they can be rapidly swung into the gun. The projectiles are raised from the shell room by two hydraulic hoists and transferred to the revolving shell carried in the gun-house. The turntable is locked while this operation is being carried out. The mounting is trained by means of a hydraulic engine connected by a toothed pinion wheel to the training rack. The gun is elevated and depressed by a hydraulic cylinder placed beneath the cradle and connected to it by link gear. The cordite charge is supplied to the gun by two cages, alternately ascending and descending in an axial hoist placed in the center of the mounting. These cages are worked by a hand winch in the handling room. The cages are balanced, and only the weight of the charge has to be lifted, so that a very rapid supply can be maintained. The trial was conducted by Captain W. H. May, commanding the Excellent gunnery school, and was attended by Captain T. B. S. Adair, representing the Ordnance Committee, and Com. G. P. W. Hope, representing the Naval Ordnance Department. More than half a gale was blowing, but the wind cleared the atmosphere, and the full program was carried out. This consisted of one round of a half charge at the horizontal, followed by a three-quarters and full charge in the same position. Full charges were then fired at 4 deg., 7½ deg., and 15 deg. of elevation. It was arranged to fire a full charge at 7 deg. of depression, but owing to the heavy lop there was on the water the depression was reduced to 5 deg. Ten rounds were next fired in rapid succession with full charges and at various degrees of elevation at the rate of a fraction under three rounds a minute. The recoil was then shortened up by using only 85 per cent of the valve key in order to bring a greater strain on the mounting, and one reduced and three full charges were successfully fired with the gun at the horizontal.—*Engineering*, London, Dec. 28, 1900.

INSTRUMENTS USED IN ACTION.

NOTE.—Under this head will be given notes on searchlights, range-finders, stadimeters, torpedo directors, etc.

SEARCHLIGHTS.—In the minds of many people the searchlight is an auxiliary of doubtful importance—more likely to betray than to defend. And evidently in the minds of many designers of ships its rôle is uncertain. The French seem to have no doubt of its importance or how to make it useful without hindrance to the effective work of the battery. They are earnest advocates of the torpedo boat and they have studied and practiced torpedo attack and torpedo defense as no other navy has. Compare their instalment of searchlights with the British or our own. They put what may be called "finding" searchlights close to the water where they will light up a narrow strip of water of great length instead of a small area. The "finders," sweeping the surrounding water, will let no guilty foe escape. The "firing" light holds brightly from aloft on the discovered enemy in a way to give the best definition of the object without blinding the gun-firers. In the new ships and in some others, the lights are placed on the stern walk, one each side; on the main deck, in ports near the stem, one each side; and in the tops. By placing the "finders" near the extremities of the ship, at a distance from the guns, they will disturb the aim of the gunners very little. Any one who has tried, on a dark night, with highly placed searchlights, to find a real enemy who was supposed to be bent on making an attack, will appreciate the advantages of the French system. And those who have seen how difficult it is, with our lights as at present installed, to pick up boats during sham attacks will perhaps realize it equally. Another point, not commonly regarded as of much importance, is the place of operation. It must be remembered that a person operating a light from directly in rear will see with great difficulty objects that are within the sphere of illumination—and other objects not at all. He should be below, above, or at one side, and at a distance of not less than 10 feet if practicable. If at one side, he should keep well in rear or have a shield of good size between him and the light. This, of course, means electric or mechanical control, and I think it is indispensable to good work with the light. I believe that simple hydraulic control through flexible tubes leading to the control station would be best. The pressure in the system need be very small, only sufficient to prevent lost motion, and would be balanced at the operating levers.

SMALL ARMS.

NEW GERMAN RIFLE, M. 87-97.—The arm is of the same caliber as the old one, takes the same cartridge, and has about the same ballistic powers. The velocity of the bullet at 25 meters from the muzzle is 620 meters (2034 feet). The barrel cover has been discarded and the piece more strongly secured to the stock. The sight leaf is pivoted at the forward end and notched at the rear end, the notch following the curve over the end and top of the rear end of the leaf. The leaf has grooves in the sides and in these grooves travel the lugs of a U-shaped slide which has a pointer touching the range scale below. The magazine holds five cartridges. They are not placed one above the other, but are staggered,

three on the right side and two on the left. This makes the lower edge of the magazine come flush with the wood of the stock and barrel casing. The cartridges are put up in the new Mauser loading strip, or clip, which simply holds the heads and is very light. The clip containing the cartridges is placed in the breech and then a pressure on the top cartridge easily forces all into the magazine and the clip, which projects nearly its whole length, is drawn out. The stock has a pistol grip and extends as a barrel casing, but underneath the barrel only, within four inches of the muzzle. The most noticeable feature of the new weapon is the bayonet which is 25.8 inches long and has a slender 20-inch blade. For infantry and chasseurs the back of the blade is serrated in the form of saw teeth. It is not attached to the barrel but to the fore end of the stock and merely rests against the barrel. The principal weights, etc., are: Weight of gun, 9.04 pounds; length, without bayonet, 49.2 inches. Length of bayonet with scabbard, 26.9 inches; weight with scabbard, 1.28 pounds; length without scabbard, 25.8 inches; weight without scabbard, 0.95 pounds. Weight of clip, 108 grains. Weight of cartridge, 429 grains; length, 3.25 inches. Weight of powder, 41.2 grains. Weight of bullet, 227.1 grains; length, 1.23 inches. Weight of clip with 5 cartridges, 5.16 ounces. Weight of box with three filled clips, 1.04 pounds. Belt containing 15 boxes (225 cartridges), 16.3 pounds.

TORPEDOES.

VARICAS TORPEDO; STEERED BY WIRELESS CURRENT.—A very full description of this torpedo and the experiments made with it appeared in the *Scientific American* of February 16, 1901. The system is the invention of a young English electrician, Mr. Cecil Varicas, and the success so far attained is quite remarkable. The torpedo is similar to the Whitehead, but in place of the Obry steering device it has the apparatus of Mr. Varicas, which consists of a Marconi coherer in circuit with a relay and battery. The relay closes the circuit of a decoherer and electro-magnet which attracts an armature. The latter is made to actuate the valve of a steering engine which is connected to the torpedo's rudder.

The stationary apparatus upon the shore, battleship, or other point from which the torpedo is fired, comprises a periodic interrupter placed in circuit with an induction coil, which in turn works a wireless telegraphic transmitter. When this periodic interrupter makes circuit the coil works the transmitter so that ether waves are produced, and the coherer in the torpedo conducts, working the relay which closes the circuit of both the decoherer and electro-magnet. This causes the valve of the steering engine to move, so that the rudder is also turned in a certain direction.

When the interrupter breaks circuit the ether waves cease, and the coherer is decohered by the decoherer and ceases to conduct—the same as is now done in the Marconi system of wireless telegraphy—causing the relay to break the circuit of the electro-magnet on the steering engine, so that it releases its armature. The rudder is then reversed to the opposite direction by a strong spring. By this it will be seen that so long as the interrupter on shore makes circuit the rudder is pointed in a certain direction, but directly the circuit is broken the rudder assumes the diametrically opposite position.

From this it will be recognized that if the alternate making and breaking of circuits is continued with regularity, answered by corresponding regular deviations of the rudder, the craft must travel in a direct straight line. On the other hand, if either the making of the circuit is longer than the period of breaking, or vice versa, the rudder is maintained in one position for a longer period, so that the path traveled is a curve.

In the trials the torpedo was made to go in a straight line to a distant point, or on a curve; to describe circles, lemniscatas, and all sorts of curves at will. The apparatus so far used is only sufficient to control the torpedo up to a distance of 200 yards, but it is said that this distance can be almost indefinitely increased by improving the sensitiveness of the instruments and strengthening the current used.

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JANUARY 12. Artillery Colors in the Civil War. The Question of Submarines. Government of Navy Yards. The Future of War. For a Naval Reserve.

JANUARY 19. Sound Reasoning on War. The Artillery in the Philippines. Paroles and Deportation. Organization of the Artillery. The Port Royal Naval Station. Shooting by Aid of Telescope.

FEBRUARY 2. "Lingo" and Language for Soldiers. The New British Service Gun. The Holland Torpedo-boat. Armored Cruisers vs. Battleships.

FEBRUARY 9. Our Troops in China. Naval Promotions for Santiago. Battleship Battery Arrangement. Submarine Cables.

FEBRUARY 16. Two Years at West Point. City Soldiers' Eyesight. New English Battleship. The Emergency Ration. Promotions in the Army. Missionaries in China. Military Establishment in Porto Rico.

FEBRUARY 23. Prospects of the Artillery.

MARCH 2. Changes at the Military Academy. Naval Appropriation Bill. Our Relations to Japan. The Revenue Cutter Service. Navies of England and Germany.

MARCH 9. Defending the Nicaragua Canal. Naval Appropriation Bill. Appropriations for Fortifications. Gun Tests at Sandy Hook. A Naval Officer on Chinese Operations.

MARCH 16. Promotion for Naval Officers. Civilizing Effect of Military Training.

MARCH 23. English Experiences of War. Germany's Rise in Naval Power. Our Influence in the Mediterranean. English Army Troubles. The Law of Naval Promotions. Story of the Monitor. Organizing the New Army. No Sheathing for New Vessels. Gruson Coast-defense Turrets. French Submarine Boats.

MARCH 30. Reorganization of the Army. Naval Policy Board. The New York Public and the Regulars. The United States Army Ration. Our Operations in China. Coaling Records in the English Navy.

APRIL 6. Reorganization of the Army. Modern Artillery. The British Seaman. The German Army in China.

ARMY AND NAVY REGISTER.

JANUARY 3, 1901. The Fighting Unit in Coast Defense. A New Compass Card. The Naval Reserve Bill. A Board Reorganization. Naval Hydrography Abroad. Circular on Extra Pay.

JANUARY 19. Report on Port Royal. Bureau Consolidation. Naval Appropriation Bill. New Army Gun. New Cables. The Revenue Cutter Service. Progress of Naval Ships.

JANUARY 26. Admiral Sumner on Port Royal. Naval Emergency Fund. Army Reorganization Bill. The Port Royal Station Report. The New Naval Bill. Assistant Bureau Chiefs.

FEBRUARY 2. Naval Appropriation Bill. The Warfare of Perpetual Peace.

FEBRUARY 9. Army Appropriation Bill. Prisoners Deported to Guam. Holland Submarine Boat. The New Army Law. Naval Appropriation Bill. Secretary Long on Naval Promotions. The Santiago Promotions. The Submarine Boat.

FEBRUARY 16. Needs for Naval Line Officers.

FEBRUARY 23. Fate of the Artillery. Careless Law-making. The Naval Supply Inspection. Naval Constructor Taylor on the New Ships.

MARCH 9. False Histories.

MARCH 23. Reports on Operations in China. Sheathing of Ships. A General Staff. Decision on Navy Promotions.

MARCH 30. Naval Bureau Consolidations. Modern Artillery.

SCIENTIFIC AMERICAN.

MARCH 2, 1901. Musical Sounds from Electric Arc. Cables for the New East River Bridge. Largest Camera in the World. Armored Cruiser. Expedition to Labrador. South Polar Expedition. Reducing Valve.

MARCH 9. Gasoline Automobile. Germany's Coal Regions. Electrical Notes. Slaby Telegraphy System. Slaby Wireless Telegraphy. Valve Motion for Pumps.

MARCH 16. Experiments with Animal Tissue. Navy Memorial Arch. Submarine Telegraph. Safety Collar for Shaft. Increasing Bulk of Steamships.

MARCH 23. The New Armored Cruisers. American Engineering Progress. Electric Lighting Board. Transport Service.

MARCH 30. New Method of Aerial Telegraphy. Builder's Trial of the Illinois. Russian Army and Marine. A Tunnel to the Isle of Wight. The International Racing-yacht Independence. Electric Wind-registering Apparatus. A New Method of Manufacturing Steel Pipe. The Porter Rotary Engine.

APRIL 6. Prospects of the New Erie Canal. Water-tube Boilers in the British Navy. Longitudinal Framing for the Herreshoff Cup Yacht. Electrically Illuminated Fountains. The New Russian Battleship Czarevitch. The 7-inch vs. the 6-inch gun.

SCIENTIFIC AMERICAN SUPPLEMENT.

MARCH 2, 1901. Dock Equipment for the Rapid Handling of Coal and Ore on the Great American Lakes. New Apparatus for Demonstrating the Revolution of the Earth.

MARCH 9. Dock Equipment for the Rapid Handling of Coal and Ore on the Great American Lakes.

MARCH 16. New Photograph Printing Frame. Trade with Russia.

MARCH 23. The Education of a Shipbuilder. The Naval War Game. American Engineering Progress.

MARCH 30. Naval Gun Circuits. American Engineering Progress.

APRIL 7. Report of the British Admiralty Committee against the Belleville Water-tube Boiler. The Museum of Artillery at Paris.

[FOREIGN.]

ENGINEERING.

JANUARY 4, 1901. Sine-wave Submarine Cable Telegraphy. Shipbuilding and Marine Engineering in 1900. Large-power Gas Engines for Central Stations. The Engineering Crisis in the Navy.

JANUARY 11. Shipbuilding and Marine Engineering in 1900. The Working of the Boiler-explosions Acts. The Safety of Lifeboats. The Engineering Crisis in the Navy.

JANUARY 18. Armor-plates at the Paris Exhibition. Shipbuilding and Marine Engineering in 1900.

JANUARY 25. Armor-plates at the Paris Exhibition. The Paris Exhibition Electric Power Station. Steam Stop Valve. The Position of Naval Engineers. The Designs of the United States Battleships. Boiler Explosion at Hyde.

FEBRUARY 1. Armor-plates at the Paris Exhibition. The New Panama Canal Proposals. Shipbuilding and Marine Engineering in 1900. Shipping and Shipbuilding in Japan.

FEBRUARY 8. Armor-plates at the Paris Exhibition. 1000-horse-power Engine and Dynamo. The Panama Canal. Naval Lessons from American Submarine Telegraph Enterprise. The New Swedish Torpedo.

FEBRUARY 22. Mica Insulation for Steam Boilers and Pipes. The New Battleship Russell.

MARCH 1. Nordenfeldt's Quick-firing Field Artillery. Naval Guns.

MARCH 8. Modern Artillery. The Supplementary Navy Estimates.

MARCH 15. The Army and Navy Building of the Paris Exhibition. The Thorneycroft-Marshall Water-tube Boiler. Water-tube Boilers in the Navy. Ship-plate planing Machine. Capped Armor-piercing Projectiles. The Water-tube Boiler Report.

MARCH 22. Army and Navy Building in Paris. Water-tube Boilers in the Navy. Capped Armor-piercing Projectiles.

MARINE RUNDSCHAU.

DECEMBER, 1900. Why was Napoleon Unable to Achieve Success at Sea? The Participation of the Navy in the Seymour Relief Expedition and the Engagements at and about Tien-Tsin during June and July, 1900. Description and Critical Consideration of the English Fleet in the East Sea during 1854. The Cyclone of Galveston, Texas. Medical Attendance and Treatment on board Ships during the 17th and 18th Centuries. Review of Foreign Navies: England, France, Russia, United States, Italy, Japan. Selections from the Official Report of the Engagement of the Russian Gunboats Gilga and Korejetz against the Taku Forts.

JANUARY, 1901. H. M. S. Gneisenau. The Education of Naval Officers in Germany, France and England—Comparison of the Different Systems. Appropriations for the French Fleet. Formulas for Determining the Military Values of Ships of the Line and Armored Cruisers. Tables of Values of Different Ships. Rebuilding of H. M. S. Hagen. Torpedo-boat Destroyers. A Short History of Compass Deviation. Cruising Reports of German Men-of-war. Review of Foreign Navies.

FEBRUARY. Discussions and Work for Naval Officials in Winter. The Navies in 1900: Germany, England, France, Russia, United States, Italy, Japan, Austria, Brazil, China, Denmark, Netherlands, Norway, Sweden, Spain, Turkey. Port Arthur and Talienwan: A Glance Back at the Seizure by Russia and Consideration of the Present Situation in the Kwantung Peninsula.

The Wounded of the German Detachment in the Seymour Expedition. The Question of Retubing Water-tube Boilers. Consideration of Sir J. D. Hopkins', R. N., Article on "A Few Naval Ideas for the coming Century." Naval Officers and Warships—from *The Engineer*. The French Navy Estimates in the Chamber of Deputies. Review of Foreign Navies: England, France (the Submarine Boat Question), Russia, United States, Italy, Austria-Hungary, Sweden. An English War Game.

MITTHEILUNGEN AUS DEM GEBIETE DES SEEWESENS.

JANUARY, 1901. Naval Strategy and the Right of Naval Belligerents. The Progress made in Ship's Armor and in Naval Artillery during the year 1900. Compass Bearings at Night. The Use of Torpedoes on Battleships. Foreign Navies: England, France, Germany, Russia, Italy, Spain, Netherlands, Turkey, United States, Japan.

FEBRUARY. Naval Strategy and the Right of Naval Belligerents (conclusion). Parson's Turbina. Foreign Navies: England, France, Germany (Gunboat Iltis), Italy, Russia, United States, Japan (First-class Battleship Schikischima). Report on the Behavior of the Niclausse Boiler on board the German Cruisers Freya and Gazelle. The Life of a Telegraph Cable. Project of a Canal to Connect the Gulf of Finland with the White Sea.

MARCH. Tactical Considerations of the Double Echelon Formation. British War Explosives. The Proposed French Marine Budget for 1901. Foreign Navies: England, France, Germany (H. M. S. Wittelsbach), Italy, Turkey, United States, Mexico, Japan. Literary Notes.

REVUE MARITIME.

DECEMBER, 1900. Yunnan (concluded). Determination of the Position of a Ship when the Horizon is not Visible. British Naval Manœuvres of 1900. Conclusions drawn from the Last Naval Wars relative to the Design of Ships. The Russian Cruiser Bayan. The New Austrian Armored Cruiser Kaiser Karl VI. System of Coast Signaling. United States Naval Budget. Trials of the Kentucky. Naval Notes. Merchant Marine.

JANUARY, 1901. The Equilibrium of a Vessel with a Compartment containing Liquid. Study of the Shock of Two Meeting Bodies. Care of the Wounded during and after Battle. Our Ships of War and their Predecessors of the same Name: the Redoutable. The Battle of Santiago (Captain Concas). Workmen in French Navy Yards from a Military Standpoint. Coaling Ship. The Formidable (British). The British Admiralty. The

Clyde and the New Naval Contracts. The New German Society for the Promotion of Naval Instruction. Norwegian Torpedo-boats. Naval Notes. Merchant Marine.

RIVISTA MARITTIMA.

DECEMBER, 1900. Naval Tactics. Naval Gunnery. Balancing of Marine Engines. Naval Exhibits at the Paris Exposition of 1900. Naval Notes.

JANUARY, 1901. Naval Programs or Types of Ships? (This is a review of recent naval construction by Chief Constructor Cuniberti of the Italian Navy and closes with a description of the new battleships Vittorio Emanuele and Regina Elena.) Navies in the Nineteenth Century. Naval Notes.

THE STEAMSHIP.

JANUARY, 1901. Shipbuilding Returns for 1900. Ship Electric Plant from the Netherlands. Ross's Pneumatic Tools.

FEBRUARY. Boiler Economy. Electric Crane. American Competition in Shipbuilding. Ship Electric-light Fittings. Turbine Passenger Steamer for the Clyde. Lost Time in Shipyards.

MARCH. Harbinger Metallic Packing. The "Buffalo" Injector. Ship Electric-light Fittings. Liquid Fuel for Steamers. Present Condition and Prospects of the Panama Canal Works. Naval Expenditure and Merchant Shipping. The Marine Steam Turbine. Trial Trip of the P. & O. Steamer Sicilia. Launch and Description of H. M. Ships Bacchante, Good Hope and Russell.

THE ENGINEER.

JANUARY 4, 1901. Life-saving Apparatus at the Paris Exhibition. The Naval War Game.

JANUARY 11. Steamship Performance. Fire-resisting Wood. The Supply of Field Guns.

JANUARY 18. The French Submarine Boats. The French Navy. New Armored Cruiser for the United States Navy. Submarine Boats. The Strategic Importance of the German Canal Project.

JANUARY 25. Shipbuilding and Marine Engineering during 1900. H. M. Torpedo-boat No. 98. Submarine Boats. American Naval Contracts.

FEBRUARY 1. Early Submarine Warfare. Boiler Explosions in France. Progress of Warship Building on the Clyde.

FEBRUARY 8. Shipbuilding and Marine Engineering during 1900. New Russian First-rate Cruisers. The Russian Black Sea Fleet.

FEBRUARY 22. Imperial Japanese Battleship Hatsuse.

MARCH 1. Shipbuilding and Marine Engineering during 1900. H. M. S. Good Hope and Bacchante. Submarine Boats. The Holland Submarine Boat.

MARCH 8. The Submarine Torpedo-boat Holland.

MARCH 15. The New Italian Battleship Vittoria Emanuele III. The Report on Water-tube Boilers. The Navy Estimates.

MARCH 22. The Progress of Aluminum—No. 1. Our New German Field Artillery Guns. Machinery for the American Navy. The Big Gun of the Americans. The French Shipbuilding Program. H. M. S. Duncan.

ANNUAL REPORT OF THE SECRETARY AND TREASURER OF THE U. S. NAVAL INSTITUTE.

To the Officers and Members of the Institute:

Gentlemen:—I have the honor to submit the following report for the year ending December 31, 1900:

Itemized Cash Statement.

Receipts During the Year 1900.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Dues	$974 06	$591 66	$166 10	$160 50	$1892 32
Subscriptions	182 69	219 35	152 35	175 03	729 42
Sales	69 78	48 88	56 05	98 13	272 84
Interest on bonds and deposits	45 50	139 21	45 50	18 00	248 21
Advertisements	297 25	232 50	20 00	489 50	1039 25
Binding	6 00	13 80	..	3 00	22 80
Credit on sales	35	..	..	..	35
Premium on money orders	..	04	07	..	11
Life membership fees	..	..	27 00	30 00	57 00
Totals	$1575 63	$1245 44	$467 07	$974 16	$4262 30
Receipts from extra publications					1503 65
Total					$5765 95

EXPENDITURES DURING THE YEAR 1900.

Items.	First Quarter.	Second Quarter.	Third Quarter.	Fourth Quarter.	Totals.
Printing and binding....	$644 58	$889 49	..	$376 72	$1910 79
Salaries.....	300 00	300 00	$300 00	300 00	1200 00
Postage.....	76 28	39 07	37 65	38 25	191 25
Expressage	14 93	3 03	4 38	4 06	26 40
Telegrams	25	25	25	3 54	4 29
Cost of articles.....	157 00	75 00	25 00	25 00	282 00
Freight and hauling.....	3 96	7 19	3 67	3 31	18 13
Discount on checks.....	1 59	2 02	1 04	96	5 61
Purchase of back numbers	3 50	..	2 80	..	6 30
Prize essay.....	100 00	..	..	..	100 00
" " medal.....	24 10	..	..	..	24 10
Rebate.....	18 00	..	..	..	18 00
Stationery	..	2 15	43 17	11 78	57 10
Repairing typewriter.....	..	11 45	..	..	11 45
Rent for safe box.....	..	5 00	..	..	5 00
Purchase 1 Infantry and Art.....	..	1 15	..	..	1 15
Insurance.....	..	..	28 00	..	28 00
Purchase of text-books...	..	..	..	24 79	24 79
Office expense	..	..	..	20	20
Totals.....	$1344 19	$1335 80	$445 96	$788 61	$3914 56

Paid for printing and binding extra publications	2919 91
Total.....	$6834 47

A liability for extra publications amounting to $2,514.00 is included in the expenditures, which was paid during the year.

SUMMARY.

Balance of cash unexpended January 1, 1900	$4782 03
Total receipts for 1900	5765 95
Total available cash, 1900.....	$10547 98
Total expenditures, 1900	6834 47
Cash unexpended January 1, 1901	$3713 51
Held to credit of reserve fund.....	299 14
True balance January 1, 1901	$3414 37
Bills receivable for 1900.....	994 60
" " " back dues	798 00
" " " binding	20 00
" " " subscriptions.....	56 00
" " " sales.....	2 55
" " " advertisements	349 25
" " " sale of other publications.....	68 01
Value of back numbers, estimated.....	875 00
" " Institute property.....	100 00
" " extra publications.....	2410 00
Total assets exclusive of reserve fund.....	$9087 78

RESERVE FUND.

United States 4 per cent consols, registered	$900 00
District of Columbia 3.65 per cent registered bonds	2000 00
District of Columbia coupon bonds	650 00
	$3550 00
Cash in bank uninvested	299 14
Total	$3849 14
Number of paper-bound copies of the PROCEEDINGS on hand at the end of the year	9308
Number of cloth-bound copies	1494
Total number of copies on hand	10802

Very respectfully,

E. W. EBERLE, *Lieutenant, U. S. Navy,*

Secretary and Treasurer.

OFFICERS OF THE INSTITUTE.

President.

REAR-ADMIRAL WILLIAM T. SAMPSON, U. S. NAVY.

Vice-President.

COMMANDER RICHARD WAINWRIGHT, U. S. NAVY.

Secretary and Treasurer.

LIEUTENANT E. W. EBERLE, U. S. Navy.

Board of Control.

Commander C. E. COLAHAN, U. S. Navy.
Lieutenant-Commander AUSTIN M. KNIGHT, U. S. Navy.
Lieutenant-Commander J. P. PARKER, U. S. Navy.
Lieutenant J. E. CRAVEN, U. S. Navy.
Lieutenant L. S. VAN DUZER, U. S. Navy.
Lieutenant E. W. EBERLE, U. S. Navy (ex officio).
Professor N. M. TERRY, A. M., Ph. D.

SPECIAL NOTICE.

NAVAL INSTITUTE PRIZE ESSAY, 1901.

A prize of one hundred dollars, with a gold medal, is offered by the Naval Institute for the best essay presented on any subject pertaining to the naval profession, subject to the following rules:

1. The award for the prize shall be made by the Board of Control, voting by ballot and without knowledge of the names of the competitors.

2. Each competitor to send his essay in a sealed envelope to the Secretary and Treasurer on or before January 1, 1902. The name of the writer shall not be given in this envelope, but instead thereof a motto. Accompanying the essay a separate sealed envelope will be sent to the Secretary and Treasurer, with the motto on the outside and writer's name and motto inside. This envelope is not to be opened until after the decision of the Board.

3. The successful essay to be published in the Proceedings of the Institute; and the essays of other competitors, receiving honorable mention, to be published also, at the discretion of the Board of Control; and no change shall be made in the text of any competitive essay, published in the Proceedings of the Institute, after it leaves the hands of the Board.

4. Any essay not having received honorable mention, may be published also, at the discretion of the Board of Control, but only with the consent of the author.

5. The essay is limited to fifty (50) printed pages of the Proceedings of the Institute.

6. All essays submitted must be either type-written or copied in a clear and legible hand.

7. The successful competitor will be made a Life Member of the Institute. If the essayist second in order of merit receive "Honorable Mention," he will also be made a life member.

8. In the event of the Prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of a gold medal.

By direction of the Board of Control.

E. W. EBERLE,
Lieut., U. S. N., Secretary and Treasurer.

ANNAPOLIS, MD., *June 1, 1900.*